THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CIX. No. 2437.] LONDON, JANUARY 25, 1910. [62ND YEAR. PRICE 6d.

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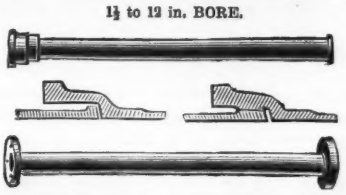

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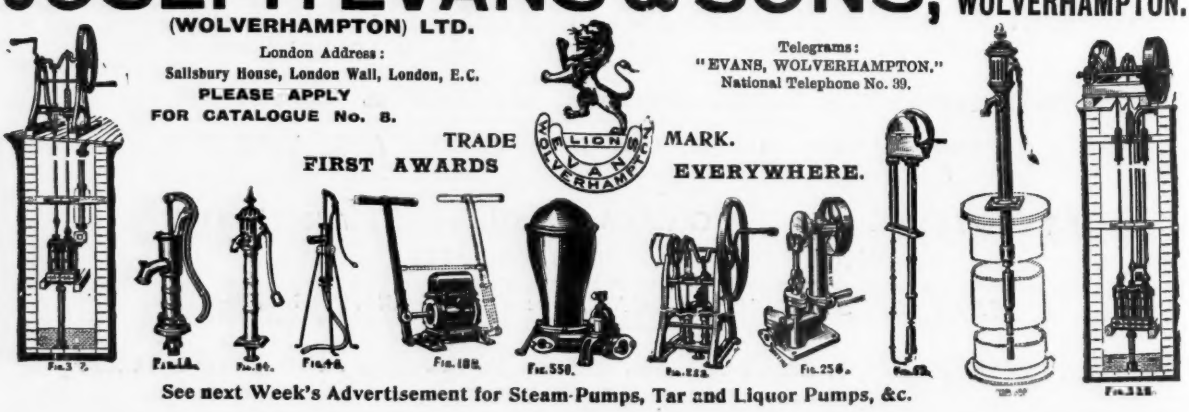

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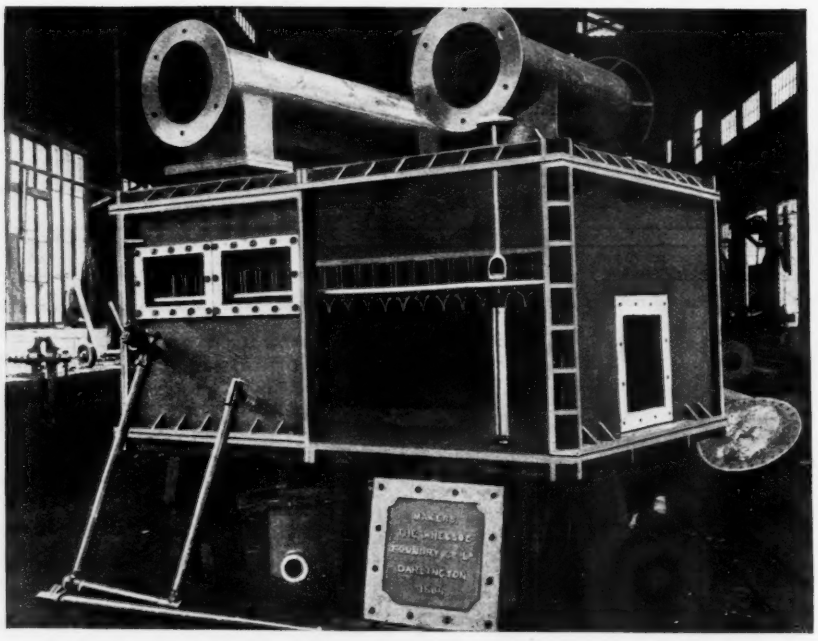

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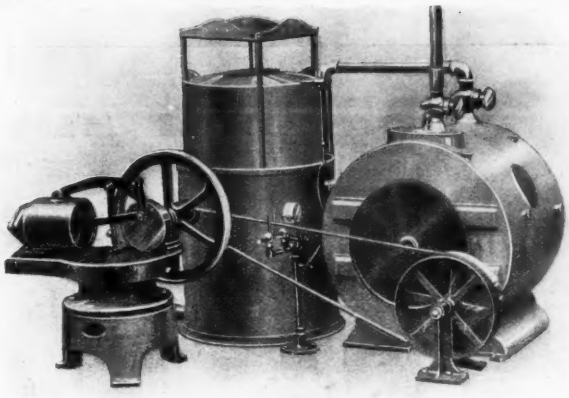

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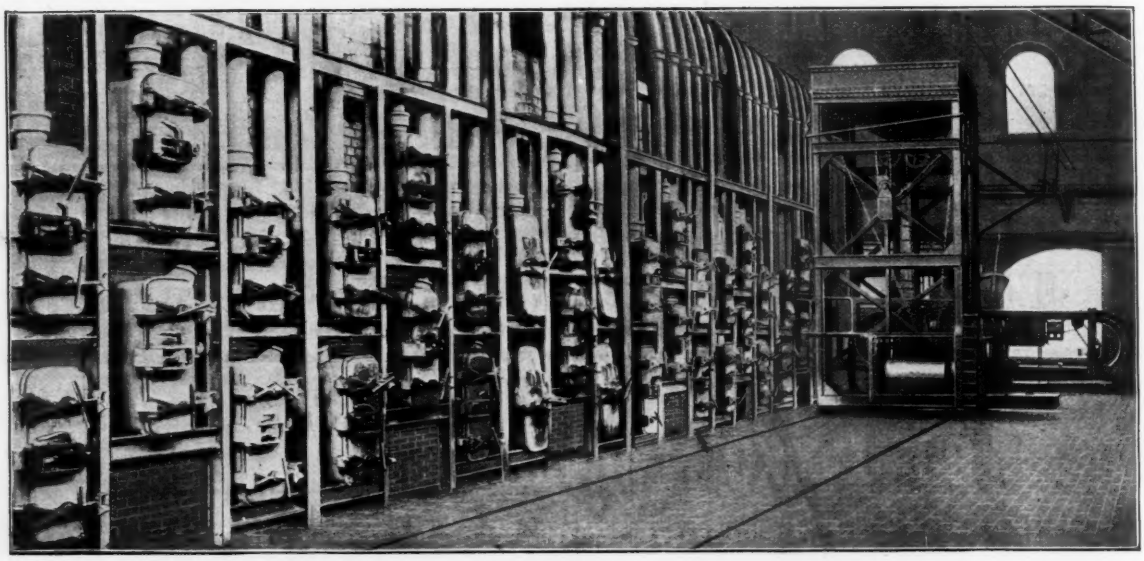

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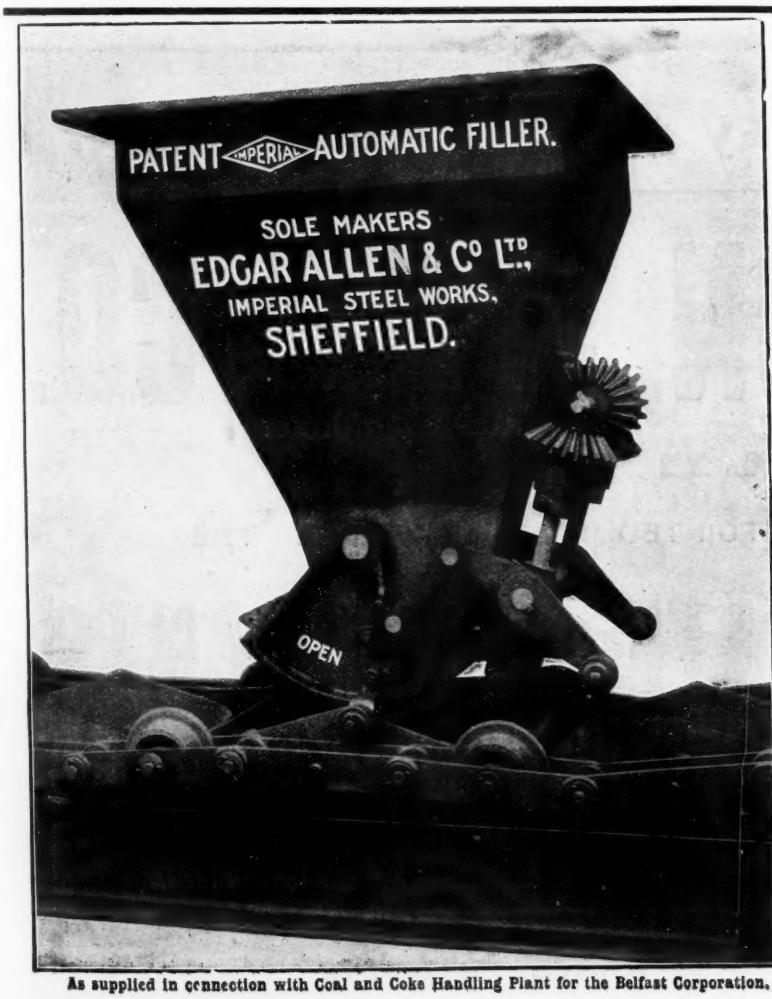

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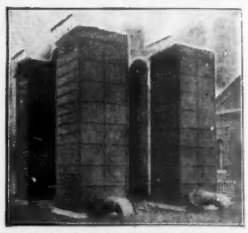

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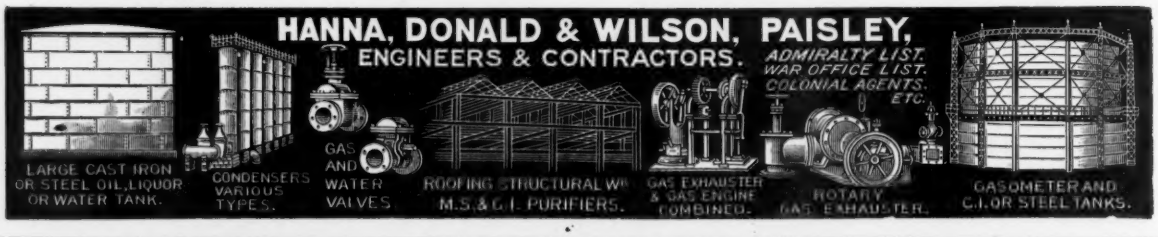
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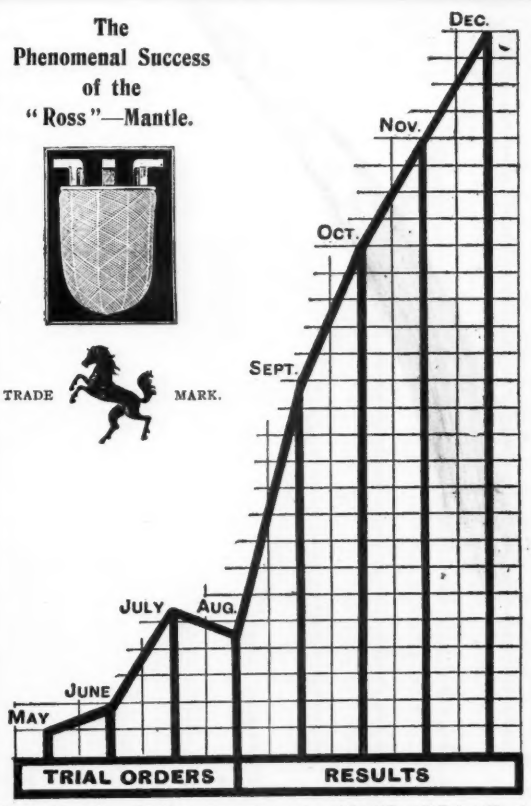

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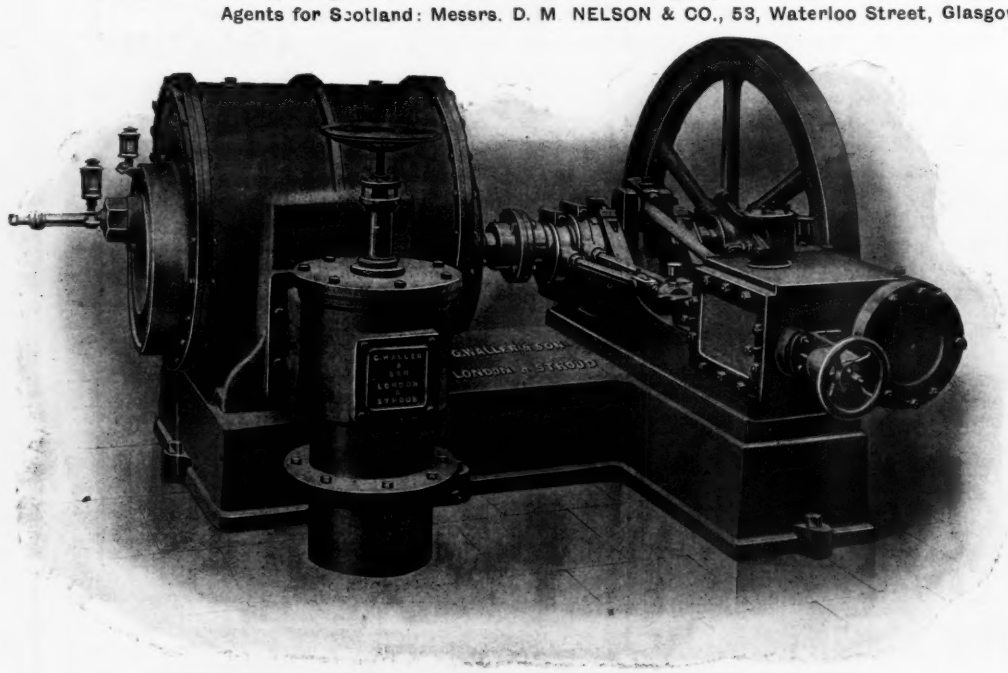

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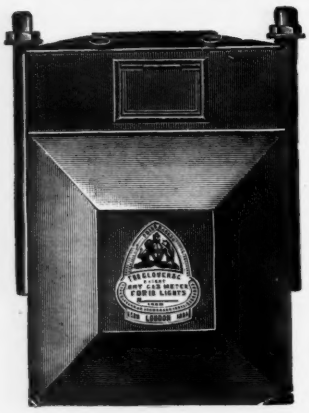

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EDITORIAL NOTES—GAS, &c.

Gas-Works Purchase—A Coke-Oven Gas Project.

THE Gas Bills deposited for the ensuing session of Parliament indicated quite a little eruption of purchasing enthusiasm on the part of local authorities—mostly of minor degree. The days of big gas-works transfers to municipal administration have passed, and for palpable reasons. In the larger cities and towns where the gas-works are in the hands of companies, the undertakings have grown to such size that the very idea of expropriation, with its financial responsibilities, rather staggers governing authorities and ratepayers alike. In the second place, in most of the larger cities and towns, the electricity supply is a municipal charge; and—though there are several instances of electricity and gas undertakings running in double municipal harness—where electricity is alone the object of municipal favour and possession, and particularly where electricity has not gained financial laurels, the notion requires considerable shifting that there is some incongruity in the taking of two competing undertakings of the kind under the municipal wing. We also agree that separation, where there is fair competition, is in the best interests of the people. Beyond these considerations, there is the further one that the tendency of parliamentary authorities is to grant shorter periods for the repayment of purchase loans than was their wont aforetime. And so it comes about that the purchase schemes of which we hear nowadays are mostly of minor order. In the total, there were half-a-dozen gas-works purchase proposals introduced by local authorities for the coming session; but all of them are comparatively of little account. The Bradford Corporation, in carrying forward their gas-supply consolidation policy, are asking for power to give effect to an agreement for the aquisition of private gas-works from the Trustees of the late Sir Henry William Ripley. The Bishop's Stortford District Council were requesting authority to purchase the local gas-works; so bringing themselves into conflict with the amalgamation scheme affecting certain, more or less, small Companies in Essex. The Egremont Council are desiring to be empowered to purchase, under an agreement, the local Gas Company's property, together with the mains of the Cleator Moor District Council and of the Whitehaven Rural District Council within the Egremont administrative area. The Hoyland District Council were seeking powers to give effect to an agreement to purchase the local gas-works. The Little Hulton District Council have an interesting scheme in hand (but the question of proceeding with it is for the moment in supension) for the purchase of distribution plant in their area, through which they are proposing to distribute coke-oven gas. The Mallow (Cork) District Council are also forward with a Compulsory Purchase Bill, which conflicts with one promoted by the Gas Company themselves for further powers.

There were thus six gas-works purchase proposals awaiting the consideration of the new Parliament; now there are four, and one of these (as remarked above) is somewhat doubtful. The reason of this reduction is that certain of the local authorities appear to have been altogether too precipitate in promoting Bills, and in incurring the expense of so doing before they had really satisfied themselves as to whether purchase would be in the interests of the district, or whether the proposals reflected the feelings of the ratepayers on the subject. As was reported last week, the Bishop's Stortford Council were, when the matter came before them, equally divided regarding the wisdom of prosecuting the scheme; and therefore a resolution to proceed could not be carried by the requisite majority. The Council, however, decided to petition against the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company's Bill; but we entirely fail to see any valid ground for opposition. Reading the speeches at the meeting on the subject of what the amalgamated Company will be able to do, and what they will not do, there is not found a shred of evidence in them of an educated appreciation of the position. When one reads of a councillor talking of the Company delivering gas of the prescribed illuminating power, but declaring that it "did "not seem to matter much of what it was composed;" when a councillor argues in favour of a Company being deprived of the notice necessary to give them an opportunity, if they think fit, of having an official present at the penalty testings of the gas, on the ground that the notice would afford the Company time to manipulate the composition of the gas; and when, too, a councillor insinuates at uncontrolled dividends being paid by a Statutory Company—then we say that the words of such men proclaim personal ignorance on the most elementary matters affecting gas supply, and its parliamentary regulation. We do not like the innuendo conveyed by such statements as those made at the Bishop's Stortford Council meeting. Directors of Gas Companies are every whit as honest as the administrators of local government affairs, and not more prone to stoop to such mean tactics (even if it were practically possible to give them effect) as those suggested. It is a great pity that so many members of municipal authorities should make themselves appear ridiculous by encouraging the most ungenerous views regarding private enterprise. It was also hinted that the townspeople did not wish to see the Company's Bill providing for amalgamation go through. If this is so, it is because the townspeople do not appreciate the advantages and the economies of reasonable consolidation in the case of gas undertakings. The Hoyland promotion is another case in which the views of the ratepayers had not been ascertained. The purchase had been arranged between the Council and the Company; but the ratepayers have exercised their right of veto, and the scheme falls through. These withdrawals indicate an insufficient consideration of this question of local policy, which insufficient consideration is a fairly costly business.

Among the Purchase Bills, there is not one that holds more interest than that of the Little Hulton District Council—not because the Council are acquiring the portion of the distribution system of the Salford Corporation within the district for £7500, and part of that of the Farnworth and Kearsley Gas Company by agreement or by arbitration, but in view of the scheme for the supply of coke-oven gas. The project (over which the question of taking a poll of the ratepayers, in view of an adverse vote at a public meeting, is under consideration) will be dealt with more fully in our next instalment of the review of the Gas Bills. But meanwhile it may be briefly stated that the Council have entered into an agreement with the Earl of Ellesmere for the supply of gas in bulk from his coke-ovens, which agreement appears to be framed in manner giving ample protection to the ratepayers and gas consumers of the district. The gas supplied is to have an illuminating power of 14 candles tested by the "Metropolitan" No. 2 burner, to be free from sulphuretted hydrogen, and to have a calorific power of 550 B.Th.U. gross. The price to the Council of this gas—after purification, and freed from sulphuretted hydrogen, but exclusive of enrichment—is to be 9d. per 1000 cubic feet for any quantity up to 400,000 cubic feet per day; but if the daily average exceeds this quantity in any year, the price is to be 7d. per 1000 cubic feet. If the gas has to be enriched to 14 candles or any higher figure, the charge for enrichment is to be ½d. per candle power per 1000 cubic feet. There must ever be the risk, in a scheme such as this, of cessation of supply, principally through labour troubles over which the District Council would have no control; and as a protection against this, the Earl of Ellesmere is to provide retort-settings, to be worked by, and at the expense of, the Council should the need arise. In the preparation of the agreement, the respective parties appear to have been excellently advised; and, if the project proceeds and is sanctioned, the parliamentary course will not by any means end technical and commercial interest in it.

Successful and Unsuccessful.

DURING the past week, the ordinary affairs of the country have been over-shadowed by the General Election; for everyone who has a stake, large or small, in the country recognizes that, in matters political, we have come to a turning-point from which we shall proceed for good or ill in the national interest. Our concern for the moment in the great contest is limited to the *personnel* of the candidates for parliamentary honours, and to their successes or defeats. As an industry, quite aside from party feelings, all must recognize that it is to its advantage to have in the House of Commons a fair representation. There are many men who are directly or indirectly connected with it in the membership of the new Parliament, so far as it is constituted. There are several names which are recognized as those of shareholders in gas undertakings; and there are others known to be those of men interested in divers ways in the fortunes of the industry. A few names of men well known in the industry in various capacities who have succeeded in their candidature may be mentioned. There is Sir Henry Kimber, the President of the Gas Companies' Protection Association, who has retained, by a flattering majority, his seat as a Unionist in the Wandsworth Division. Sir Daniel Ford Goddard, the Chairman of the Ipswich Gas Company, returns to Westminster in the Liberal interest. Mr. E. A. Brotherton continues his representation of Wakefield as a Unionist. Mr. J. H. Duncan, a Director of the Otley Gas Company, was successful in his fight, on the Liberal side, in the West Riding of Yorkshire. One of the Directors of the Power Gas Corporation—Mr. Alfred Mond—has come from Swansea triumphant, in the Liberal interest. Sir Philip Magnus, who has long been identified with the City and Guilds of London Institute, returns to Parliament as the Unionist representative of the University of London. The Secretary of the Gas Workers' Union, Mr. Will Thorne, who is a good specimen of the militant Socialist, goes back to Westminster as a representative for West Ham.

But there have been others associated with the gas industry who have failed in their candidature. Sir William R. Plummer, one of the Directors of the Newcastle and Gateshead Gas Company, espousing the Unionist cause at Newcastle, was unsuccessful, as was also Mr. R. J. Neville, one of the Directors of the Brentford Gas Company, in standing as a Unionist at Wigan. It was a brave fight that Mr. A. P. Main made in the Unionist cause in the Tradeston division of Glasgow. He was, on heavy polling, only 193 votes behind the victor, which augurs well for success if he enters on the struggle when occasion again offers. Mr. H. Pike Pease, as a Unionist, failed to secure a return to Westminster; but his opponent only headed him by 29 votes. A kinsman—Mr. T. H. Berridge—of the Engineer and Manager of the Leamington Gas Company, was, as a Liberal, beaten in contesting the seat at Warwick and Leamington. Through his rejection at East Bradford, the Parliamentary Bar retains the brilliant forensic powers of Mr. J. H. Balfour-Browne, K.C.; and not a few who have occasion to apply for parliamentary powers by way of Private Bill will rejoice over the fact. Lord Robert Cecil is also at liberty to take up his work again at the Parliamentary Bar, through his rejection at Blackburn. There are a few other candidates in whom we are interested whose success or otherwise has still to be announced.

An Instructive Report on Electrolysis.

WE are sorry to learn from the report on Electrolysis published in other columns that the Special Committee of the American Gas Institute who have been dealing with this subject, and the Chairman of which was Mr. A. G. Glasgow, have been disbanded; but they have left as a memorial of their existence a good record of instructive work. The main troubles with which the Committee have been confronted have been that systematic and scientific research into this matter of the effect of stray electric currents on underground distribution systems is not carried on under different conditions, and that local interests are so interlaced that, when investigations are made, the results appear to be mostly of a confidential character, and for the good, and possibly the peace, of local interests there is a delicate reserve in making disclosures. In face of this, the Committee cannot see their course clear to the making of any further substantial headway. But they have accumulated quite sufficient evidence in the former report and in the one now presented by Mr. A. F. Ganz, Professor of Electrical Engineering at the Stevens Institute of Technology, to show that periodical scientific and systematic electrolytic surveys of gas distribution systems should be instituted for protective purposes. Damage here and damage there is nowadays taken as a matter of course; but it would be better to make some attempt at warding off these disturbing occurrences by a proper inspection.

The report by Professor Ganz is very informative, and is written in a style that can be appreciated by practical men. It gives instruction not only from experiences, but shows what to look for, and where to look for it—treating, too, of some of the more generally applied expedients in America for preserving the subterranean pipe distribution systems from injury, and imparting ideas as to their relative value. Traction concerns can take care of their own current completely by the use of an insulated return circuit; but even without this, as Professor Ganz points out, it is possible, where serious stray currents are found flowing on underground structures, to reduce them to small and oftentimes negligible amounts by proper track-bonding, and by the installation of properly proportioned return feeders, with the addition in some cases of negative boosters. In two American cities, the installation of properly proportioned radiating return feeders has reduced stray currents on the piping systems to less than one-tenth of their former value. It is clear, however, that care must be taken, in the choice of system for preventing damage, to have respect for other underground systems. In the case of a pipe system that is a continuous electrical conductor of low resistance, and is affected only by currents from known sources, it may be protected by metallically connecting it to the negative return circuit of each source. But there are several objections to such a method of bonding; and the greatest one is the danger that it constitutes to all other underground metal systems. The dangers produced may be far greater than the danger it is sought to avoid on the protected system. Professor Ganz is emphatic in his belief that only such methods should be used as substantially prevent stray currents flowing to and from underground structures.

Much protecting work may be done within subterranean pipe systems themselves, but not, it is obvious, without considerable expense and inconvenience. The favoured systems in America are by insulating pipe-joints and insulating pipe coverings. These methods are expatiated upon by Professor Ganz; and at the close of the study of his investigations and the collected experiences, there is no doubt whatever in the mind as to the former being the preferable in the matter of smallness of deficiency. Cement joints are largely in favour; and the evidence all points to the fact that a pipe-line laid with all cement joints has such a high electrical resistance that, with the potential differences ordinarily found in the ground, no measurable current can flow along such a line. This being so, bond connections between the cement jointed mains and the return circuit of electric railways can only each protect a single length of pipe, and not the whole of a pipe system. Of course, it is not submitted that cement jointing necessarily implies complete immunity from electrolysis; but it is a protector in which a large share of reliance can be placed. As a matter of fact, cement is not an insulator. But its resistance is high compared with iron; so that the cement does practically interrupt the electrical continuity of the pipe-line. The efficiency of the cement joint, however, depends upon attention being paid to the detail of making the joint. If there is metallic connection between spigot and socket in any way, the resistance efficacy of the joint is partially destroyed; but this can be readily avoided by introducing at the end of the spigot a ring of insulating material, so as to break metallic contact with the socket. This is simple enough; but there are other considerations than electrolytic ones upon which more information is required. It may, however, be generally inferred, from the considerable trial that has been made of the cement joint in America, that it does also commend itself from other practical points of view than that of offering resistance to the flow of stray electric currents. The reports on special forms of insulating joints vary—some users speak highly of them; while the experience of others has not been confirmatory. Experiments made by Professor Ganz on a pipe-line fitted with Dresser joints did not reveal any measurable flow of current; and he is of opinion that, though the introduction into a gas distribution system of a few insulating joints will not eliminate electrolytic danger,

it may greatly reduce it in certain localities, while in others the joints may do more harm than good. Insulating coverings for mains are not particularly well spoken of in the report; and the cost is prohibitive so far as general application is concerned.

Many gas engineers in this country have had what Mr. James Swinburne once termed "gruesome" examples of electrolytic action on service-pipes in thoroughfares where there are electric tramways; and in America it would appear they get a pretty good crop of such affected services, even where there are cement-jointed mains. Though the flow of current may not be measurable along mains so jointed, the connected services are not immune from severe punishment. Professor Ganz has had a bundle of gas services sent him for inspection that have been so affected, though connected up to a cement-jointed main; and, in his experiments on a lead-jointed water service, connected up to a cement-jointed main, he found it was carrying large stray electric current. An uncomfortable feeling might be generated if it were generally known that stray currents are entering houses *viâ* the water service and returning through the gas service-pipes. With electrolytic action proceeding on the gas service-pipe, one can well imagine there would be a distinct fire hazard there. Of course, this travel of the vagrant currents within houses could be prevented by making arrangements to use insulating couplings in the service-pipes.

From this general glance at the contents of the report, it will be apparent to readers that there are quite a number of interesting and instructive points bearing upon this question of electrolysis to be picked from the document. Among the miscellaneous ones, for instance, it is found that the resistance of lead-wool joints appears to be about half that of the lowest resistance of cast-lead joints. This is possibly accounted for by the fact that the lead-wool joints make contact with the iron of the pipes over a greater area than in the case of cast-lead joints. In other words, an advantage is discounted by a disadvantage. Another noticeable feature is that old pipes are much less subject to trouble from electrolysis than new pipes; the surface corrosion forming what is practically an insulating covering. Going to other parts of the report, it is regrettable that, after all his inquiry, Professor Ganz is unable to come forward, and say with confidence that there is a specific for electrolysis. He does not know of one. The electricians on this side will take refuge in the Board of Trade regulations, and suggest that Professor Ganz has possibly overlooked them. We have no doubt as to his perfect knowledge of them; and, notwithstanding that knowledge, this Professor of Electrical Engineering cautions all against any false security. A statement that a given pipe system is not suffering from electrolysis cannot, in his view, be taken as good evidence that the system is actually free from stray currents, and is immune from electrolysis, and especially is this so with cast-iron mains carrying gas at ordinary pressures. This being his well-considered opinion, a periodical systematic scientific survey is, in his judgment, very desirable—an opinion in which all will agree.

Some Stringent Supply Conditions.

THE fusion of the Buenos Ayres (New), the River Plate, and the Primitiva Gas Companies is now an accomplished fact; and to those concerned in gas supply under home conditions, the terms of the contract (as noticed elsewhere) entered into by the Company with the Municipality of Buenos Ayres will be of interest. The Municipality have long had a reputation for driving a hard bargain with those largely dependent on their goodwill and toleration; and, in the making of the new contract, there has been no departure from that reputation. A little easing here and there of the conditions, and the consolidated gas undertaking could have been operated to much better advantage in furtherance of the common weal. The Company have been subject to a sort of tight-lacing all round. We complain in this country of the gyves forged at Westminster which hamper industrial freedom. Our restrictions, however, are light compared with those which now apply to the gas supply of Buenos Ayres. The Municipality appear to have been looking round to discover any and every limitation that they could employ; and they have made use of all they could detect. The price the Company are allowed to charge may, according to British notions, seem to be high; but sight must not be lost of the differences in respect of conditions—particularly coal, labour, and capital. Provision is made for reductions from the maximum specified rates to the extent of 25 per cent.; and then the reductions are to cease, except in the event of the Company adopting any new invention for making gas which may allow of a saving to the extent of 20 per cent. in the cost of production. Thereupon the maximum charges are to be reduced to the extent of one-half the economy effected. This reminds of the similar stipulation (without special definition of a moiety of the economy going to the consumers) in the contract between the defunct Paris Gas Company and the Municipality, which provided for the holding of quinquennial inquiries, with the view of ascertaining whether there had been any improvement introduced into the working calculated to effect substantial economy in production; and if it were found that this had occurred, the Company were to give the public and private lighting the benefit of it, in the shape of a reduction in price, in proportions determined by the Administration, acting under the advice of the Municipal Council. But the provision might just as well have not existed for all the good it did.

Another departure from British practice is the limitation imposed on the use of straight or carburetted water gas, unless unavoidable circumstances necessitate an increase. The quantity of water gas permissible under this stipulation is not to exceed an amount that will raise the proportion of carbon monoxide in the mixed gas above 17 per cent. by volume. This means that rather more than one-third water gas may be used in the output. The allowable percentage of carbon monoxide is 1 more than was recommended in 1899 by the Home Office Committee; but no occasion has been found for acting upon the recommendation, either by legislation or agreement, in this country. Therefore the necessity of the restriction in Buenos Ayres is not supported by experience. The Company are also placed under obligation to adopt any method which, in their opinion, or in that of the Municipality, will permit of the reduction of the quantity of carbon monoxide in the gas, or will in any other way improve its quality. There are also to be penalty testings for both illuminating power and calorific value; but in respect of the latter, the conditions must be regarded as very onerous —more so than those accepted, in the interests of their last Act, by the Gaslight and Coke Company. The illuminating power of the gas in Buenos Ayres is to be 14½ candles, as tested by the "Metropolitan" No. 2 burner; and the calorific power at least 539·2 B.Th.U. net per cubic foot, as tested by a Simmance-Abady calorimeter. An illuminating power of 14½ candles and a calorific power of 539·2 B.Th.U. net have, generally, a somewhat distant relationship. Unlike the calorific standard of the Gaslight Company, this Buenos Ayres one of 539·2 B.Th.U. net is unconditional, and right away for every lapse of 5·5 B.Th.U., a penalty of $30 is to be inflicted. The standard is altogether too high (see "JOURNAL," Oct. 5, p. 13). In fact, we fear the Company will have some difficulty in working to it; and at the same time they and the consumers will be denied the advantage of the economies that greater freedom in manufacture would have enabled them to work for. This is an instance of liberty and authority being antagonistic, and limiting (through the latter) action to the production of the best service to the greatest number.

Mysterious and Suspicious Fires.

It has been the boast of electricians that most of the palatial buildings of the world, in which expense is no particular object, are lighted electrically. The fact may account for what is so obvious that instances of such buildings being destroyed by fire, with the attendant great monetary waste, are more frequent now than in pre-electrical days. That is a point which throws strong suspicion on the introduction of electricity. But though in some of these cases there is all but positive evidence as to electricity being the cause of the conflagration, the reporter of the occurrence who dares to throw out a hint as to where suspicion rests, is bombarded by the severest denunciation from electrical quarters. In many of these cases, the cause (if it be electrical) is effectually wiped out by the fire; and any certainty, of course, must then depend upon the evidence of those who witnessed the origin of the outbreak. *Causa latet, vis est notissima.* The Clapham, Kilburn, and other fires of recent occurrence at home are all too well embedded in memory. According to report, electricity does

not confine its claims to any class of property; its disinterestedness is one of its characteristics. Royal Palaces are said to come within its consuming scope. On the 6th inst., a royal palace near Athens was destroyed by fire. "It is believed," wrote the correspondent, "that the fire was caused by a short-circuit, or by a burning candle." The Turkish Parliament House was completely gutted by fire last Wednesday. The "Daily Telegraph" correspondent says: "The fire was caused, so far as has been ascertained, by a short-circuit in the electric lighting apparatus, though a few of the deputies and fire brigade officials say that it may have had a more mysterious origin." The estimated loss is £4,000,000. From Philadelphia came accounts last Wednesday of a big factory fire, involving the death of at least a dozen young women, and serious injuries to about twenty men and girls. The attributed cause of the disaster was the "fusing of an electric light wire." Last Sunday week, Hackness Hall—the seat of Lord Derwent, near Scarborough—was destroyed by fire. The cause "is believed to be the fusing of an electric wire in one of the bedrooms over the portico of the hall." Reverting to the Clapham Junction and Kilburn fires, it is stated that the London County Council are contemplating introducing legislation to deal with the subject of the illumination of drapers' windows by any kind of artificial light.

The Accounts of Borough Councils.

In another part of to-day's issue, there will be found some figures extracted from Part V. of the Annual Local Taxation Returns, which deals with the accounts of Councils of Boroughs other than Metropolitan Boroughs. These statistics, which unfortunately bring us up to no later date than March 31, 1907—being for the twelve months ending at that time—relate to the affairs of the 326 boroughs (exclusive of the Metropolis) that were then in existence; and there is little else than columns of figures to be found in the 250 pages of which the Blue-Book is composed. The figures show a great deal; but perhaps the one thing above all others that they make clear is the huge importance of municipal work nowadays from a financial point of view, as well as when regarded in its other aspects. Doubtless there have since March, 1907, been substantial additions made; but even at that date the total amount of the outstanding loans was practically £244,000,000, compared with about £240,250,000 twelve months before. Of the large number of purposes for which this money has been secured, the following few may be specially mentioned: Tramways and light railways are responsible for £21,230,598; electric lighting (including public electric lighting), for £20,411,595; gas-works, for £19,499,723; water-works, for £60,083,232; public roads and streets, for £27,466,538; sewerage and sewage disposal, for £20,272,714. These are all (with the one exception of gas) increases over the previous year; and education is another heading which has also grown—from £18,240,723 to £18,734,580. With regard to the figures in reference to gas and electric lighting, it may be mentioned that, as compared with the immediately preceding returns, the gas-works loans outstanding show a decrease of about £140,000; and those for electricity have increased by some £368,000. While the decrease in the case of gas is very much the same as was shown in the accounts issued twelve months ago, the increase under the head of electric lighting has fallen from £1,250,000 to the £368,000 just stated. The total rateable value of the boroughs, it will be seen, is over £73,000,000. As was the case the previous year, the Blue-Book which is now under notice contains a table showing the transfers that have been made in aid of rates out of profits from, and the transfers from rates to make up deficiencies in revenue on account, of four classes of what are usually known as "reproductive" undertakings. The statistics in this respect show that for the year 1906-7 there was a total profit on tramway and light railway, and gas, water, and electricity supply undertakings (the four classes included in the table) transferred in aid of rates of £1,072,745; while the extent of the loss which had similarly to be made good out of the rates was £318,807. Gas-works are once more responsible for by far the largest profit (£490,767), as well as for the smallest loss (£795). With regard to water-works, the total losses taken from the rates as usual come to considerably more than the aggregate profits by which the ratepayers directly benefited; the former figure being £238,361, the latter £102,448. As to electric lighting, the profit transferred in aid of the rates is £90,899; and the loss which had to be made good, £26,798.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 256.)

THE Stock Exchange had another animated and interesting week. The two central points round which movements turned elliptically were the elections and cheap money. The former exercised a potent influence (the returns being awaited and received with a degree of fervour which at times almost impeded business); but the steady cheapening of money had, *per contra*, an agreeably soothing effect. The opening on Monday was not over-bright. Saturday's election returns, though good, were not good enough to satisfy; and so the tendency became dull, with quiet business. Most of the markets suffered a set-back. Consols fell $\frac{7}{16}$; Rails receded; and most of the rest were weaker. Tuesday began still in a dissatisfied mood. Consols fell another $\frac{3}{16}$, but cheered up later on; and Rails moved sympathetically. But Wednesday improved matters materially. The gilt-edged division gathered strength, while Rails made a general advance. Some speculative lines, however, were very irregular; and Americans were odd all the week. On Thursday, the Exchange became enthusiastic over the election results, to a degree almost embarrassing to sober business. But the best markets could not help rising, and Consols gained $\frac{5}{16}$. Friday was much the same—full of politics, and generally strong. Railways advanced by satisfactory announcements. Saturday was quiet, and for the most part unchanged. In the Money Market, the fall in the value of money was continuous and steady. The Bank of England rate was reduced from 4 per cent. to 3½ per cent. on Thursday; and the German rate was lowered on Friday. Business in the Gas Market was only moderate in point of volume; but there was a good undercurrent of strength, which came to the top now and then in advances of quotation. The leading item of the week was the Gaslight and Coke dividend announcement, with a carry-forward higher by £47,000 than last half-year's. This sent the quotation up fractionally; and dealings which were marked at 104 on Monday touched 105 on Saturday. In the secured issues, the maximum was ¼ better, at from 88¼ to 89; the preference realized 105; and the debenture, from 82¼ to 83. South Metropolitan was quiet and strong, changing hands at from 121 to 122; and the debenture fetched 81½ and 82½. Nothing was done in Commercial. Among the Suburban and Provincial group, Brentford old marked 254 free and 256, ditto new 191, Brighton original 219, South Suburban 121¼. Wandsworth and Putney debenture and Tynemouth ordinary rose 1 each. In the Continental companies, Imperial was very quiet, and was unchanged at from 175¾ to 176¼. European part-paid made 18$\frac{11}{16}$. Among the undertakings of the remoter world, Buenos Ayres changed hands at 14½ and 14$\frac{5}{8}$ (a rise of ¼), ditto debenture at 97$\frac{3}{8}$, Hong Kong at 17$\frac{7}{8}$, Ottoman at 6¼, Primitiva at 7$\frac{1}{8}$, ditto preference at 5$\frac{5}{16}$ and 5$\frac{9}{32}$, ditto debenture at 99 (a rise of 1), River Plate at 17, San Paulo at 14$\frac{7}{8}$, and ditto preference at 12$\frac{1}{8}$.

ELECTRICITY SUPPLY MEMORANDA.

How not to Counteract the Effects on Supply Undertakings of the Metallic Filament Lamps—Reducing Consumption by Them in Street Lighting—For Small Householders on the Contract System—Metallic Filaments and Visual Degeneration—Replacing Lighting Units by Low-Price Power Ones.

THERE was recently a paper read before the Leeds section of the Institution of Electrical Engineers by Messrs. G. Wilkinson and R. M'Court, in which were, after a manner, discussed the possible—not actual—beneficial effects of metallic filament lamps on supply undertakings. The authors hail from Harrogate; and the scheme of the paper was to give some idea of what has been done in that favoured seaside resort to counteract the effect of the introduction of metallic filament lamps. The first section of the paper deals with the positive and prospective overthrow of electric arc lamps by metallic filaments. As the latter considerably reduce the revenue derived, there is failure to see how this can be classed among the counteractive efforts to stem consumption reduction. There it is, however; and so it may be referred to. True by way of trial only, a stretch of residential road in Harrogate has been dealt with, where twenty open-type arc lamps formerly did duty. The nominal 100-candle metallic filament lamps adopted in their stead number 46; and they are suspended in couples, with two of the standards bearing four lamps each. It is admitted that the illumination given by the two-light lamps is not so good as that formerly imparted by the deposed arc lamps; but it is claimed that the effective illumination on the roadway afforded by the four-arm lamps is at least comparable with that of the old arc lamps, and much better round the base of the lamp itself. We can recall the candle power attributed to arc lamps in pre-metallic filament days, and the electrical arguments for high-power sources of light. It is now electrically considered that this stretch of road is adequately lighted by, in the major part, 200-candle power sources; the inference being that with the arc lamps it was overlighted. The cost of altering the twenty standards was £91 (an average of £4 11s. each), though no alteration to the mains was required. Then there are the annual costs for the old system of lighting and the new. For the

arc lamps, the current is put down at £169, trade account at £22, wages at £61, which three items are calculated in the print of the paper before us to amount to £270, which is not precisely accurate. Following, the cost of the 46 metallic filament lamps is put down at £91 17s. 4d.—current being estimated, at 1½d. per unit, at £56; renewals at £29 7s. 4d.; wages at £6 10s. It is stated that the lamps are switched out at 12.30 a.m. If this is so, and they are lighted up at dusk, would not the number of lighting hours per annum be 2355? and reckoning 125 watts per lamp per hour, and 1½d. per unit. would not the cost of the current for the 46 lamps work out to £84 12s. 4d. and not to £56? Before leaving the question of public lighting, there is another interesting point. The authors aver that they have made many tests of street lamps by the aid of portable photometers; and they find that a 3 feet per hour incandescent gas-mantle does not give a light of more than 30 candles, while with metallic filament lamps 30-candle power can be obtained for 33 watts! That is to say, something better than the laboratory efficiency can be obtained, using the portable photometer, from metallic filament lamps in street lighting; while, removed from the laboratory to the street lamp, the incandescent gas-burner will only give an efficiency of 10 candles per cubic foot of gas consumed, instead of double that quantity! Strange! but a pair of electricians say it's true; so what is the good of denying it, seeing that veracity is such a common trait in the electrical profession and advertising literature. The inquiry just flits across the mind as to why these gentlemen did not pit against the 30-candle power metallic filament a small inverted burner which class of burner has a higher efficiency than the old "C" burners.

In the discussion, not much notice was taken of the street-lighting section of the paper; interest being entirely concentrated round what Harrogate is doing to "counteract the effect of the metallic filament lamps" in the dwelling-house. What has been done does not strike one as being worthy of rank as particularly notable. It only amounts to a little essay at getting hold of small consumers under a contract system—that is to say, under a charge of so much per lamp per quarter. But with what degree of success is not (so far as the report before us gives enlightenment) stated. The argument in favour of the contract system is a lonely one—the reduction of the cost of installation by doing away with the protective meter. On the other hand, the arguments against have a plurality. To supply at so much per lamp is not an ideal system. It is merely a reversion to the old days of gas lighting; and the experience then will not induce the gas industry to again have recourse to the plan. There are not, fortunately for them, many electrical engineers who regard the proposal with favour. They know that it is human to err; and that laxity in operating the switch when lights are not actually required is bound to be a growing quantity. All the supply conditions that may be invented in the circumstances will not afford the central station protection in this regard, without some mechanical watcher in the shape of a meter. The terms at Harrogate are: (1) The consumer to supply his own lamps. (2) Each apartment in which a lamp is installed must be adequately lighted by windows in the daytime. (3) The maximum number of lamps to be alight at one time to be declared at the commencement of the contract. (4) The minimum number of lamps applied for to be two, and the maximum six, each taking 30 watts. (5) The charge to be 2s. 9d. per 30-watt lamp, payable in advance. Now what protection is there here for the electricity undertaking, and for the consumers who use and pay for electricity for lighting on the ordinary terms, or who under the contract system are honest in their employment of the current. This contract system is to say the least a clumsy device, and for the consumers not a cheap way of obtaining light.

Supposing a small householder has half-a-dozen of the 30-watt lamps installed (each representing about 24 candles), at 2s. 9d., these would represent an expenditure of 16s. 6d. per quarter, or £3 6s. per annum, in addition to which there would be the metallic filament lamps to pay for. A bijou inverted gas-lamp will give as much light as, or more light than, a 30-watt metallic filament; and 1000 cubic feet of gas, according to quality, will suffice for such a lamp for from 800 to 1000 hours. So where, from the point of view of economy, is the small consumer to gain from turning over from gas to electricity? There is another aspect of the question. Mr. Wilkinson himself does not see how electrical stations are going to get cooking and heating into small houses where there is competition with gas. Prepayment gas consumers are, generally speaking, excellent patrons of the cooking-stove and boiling-ring; but gas undertakings would be very glad if they could say that their prepayment consumers averaged a payment of £3 6s. a year for both lighting and cooking, and not for lighting alone, as is proposed for the six 30-watt light man. Another point is that if this contract system is to succeed, even in a small way, the principle should be extended, so as to include the maintenance of the metallic filament lamps. The small householder does not like unexpected expenditures of a few shillings. His present solid disbursements on necessities are quite sufficient for him, without adding to them. He much prefers—it is the habit of his class—to buy in small quantities, as he goes. Once he has bought his incandescent burner, the expenditure does not recur for years. He has merely a few pence to spend occasionally on the renewal of a mantle, instead of shillings on the metallic filament lamp. One of the speakers in the discussion of the paper was Mr. R. H. Campion; and he made this very point as to lamp renewals. He confessed that his experience in the lighting of cottages had not been very successful. He obtained a few cottage consumers by inducing the landlord to charge his tenants 1s. extra per week for lighting. There are but few landlords who would be prepared to jeopardize the letting of their cottages by adding 1s. to the rent for the benefit of someone else. But these cottages were not connected for long; and the lamps used were of such a description that the department were not sorry when they were disconnected. The cottagers would not replace a lamp costing 9d., no matter the condition it was in. In Mr. Campion's opinion, upon this experience, he is afraid that the extra cost of metallic filament lamps is going to be a serious thing in obtaining the patronage of the small householder. Of course, it is the excellent business that gas undertakings under their conditions (which are not identical with those of electricity supply) can do with small householders through the prepayment meter system that raises the envy of electricians. Electric prepayment meters have not proved successful; and some electricians who have got them would now rather be without them. As Mr. Wilkinson says, their cost is heavy; and they are troublesome to maintain. They soon become full of coppers if a "large" amount of light is used; and then it is necessary to send someone to remove the coins, seeing that otherwise the meters become jammed, and the supply is either cut off, or, worse still, the circuit is not broken, and the users get a further supply free. The reason they become jammed so quickly is that, if a consumer is using simultaneously (say) four 30-watt metallic filament lamps, and the covering charge on the prepayment system is 8d. per unit, he has to drop a penny into the box every hour; if the covering price is as low as 6d. per unit, he has to part with a penny every 1¼ hours.

There is not the slightest doubt that the metallic filament lamp is considerably worse for the eyesight than the old carbon filament lamp—though that was bad enough. We know of workers pursuing their daily vocations in places where metallic filament lamps are used pretty constantly, through the absence of proper provision of natural light, who complain bitterly of the aching and strain experienced by their visual organs since the new lamps have been brought into use by their employers on the grounds of economy. Money saving by the employer on his electricity bill will not compensate the employee for degeneration of his eyesight, owing to the great intensity of the hair-like filaments. The matter ought to be kept well in mind by those who are responsible for lighting schools, as there may be more damage occasioned there to the eyesight of the nation than anywhere else. In one of its editorial articles, the "Electrician" has been referring generally to the subject of the metallic filament lamp; and it is noticed that, now the "turmoil" associated with the introduction of the metallic filament lamp has settled down, our contemporary is able to perceive that one of the two principal differences which have been caused by its introduction is "that greater care will be taken—in fact, will have to be taken, if we are not to suffer optically by the abuse of the light." We agree as to the danger; and compliment our friends on recognizing it. The means of suppressing it is by the judicious employment of shades. But this has the effect of depreciating the amount of useful illumination afforded by the lamps on a given consumption of electricity, and, on the illumination basis, renders the electric light still dearer. While our contemporary's interest is at a high pitch on this subject, it would be well if it would urge the issuing of a warning to shopkeepers who make metallic filament lamps the most prominent feature of their shop windows, instead of the goods they wish to dispose of. The result is that the would-be buyer is blinded to such an extent that the virtues of the tradesmen's wares are hidden from him. The glare—"glare" is a subject that was well forward in our columns last week—is too much for him; and he passes on to windows that are lighted in a more prudent manner. Illumination with discrimination is not always practised by the shopkeeper; and what cares the electrician so long as he retains a consumer, or gets a new one?

The "Electrical Times" has given, through concrete figures, confirmation to the generally recognized fact that the majority of central stations in the matter of the demands upon them have latterly been practically merely marking time, and that some have actually suffered decrease, while others have enjoyed increased outputs, but (as has been frequently pointed out in the "Memoranda") at power and not lighting rates. The data supplied refer to the maximum loads at electricity works for the past three years; and looking down them, it is easy to pick out, from the figures alone, the towns where the power load has come in, if not remuneratively, conveniently to swell the load, as well as the residential towns where lighting is really the only class of business obtainable. The comments of our contemporary may be reproduced here: "That station revenues have suffered a set-back from tungsten and tantalum lamps is a fact only too well established. But we believe that electrical manufacturers will be agreeably surprised to find that, on the whole, maximum loads have gone up. There have been sad fallings-off here and there; but in the majority of cases the worst that has happened has been a slowing-down in the rate of growth." The aggregate of maximum loads represents a growth at the rate (roughly) of 5 per cent. per annum. "Probably this is a slight over-estimate, since a certain number of stations have omitted to send in their loads; and no doubt some of these are reticent because they have retrogressed. But it can, we think, be taken for granted that in any case the aggregate demand on the stations of the country has not diminished, but is increasing. The rate of growth has slowed-down

greatly, but still we have neither come to a standstill nor receded. What has happened is fairly obvious. The drop in demand, owing to the replacement of carbon by wire lamps, has been slightly off-set by the accelerated accession of new lighting customers, but the big countervailing item is the rapid increase in the power business. *Financially, there has been a wholesale replacement of high-price lighting units by low-price power units;* and we fear that some little time must elapse before the proportion of lighting to power units will increase." In the last portion of this quotation, it is evident that there is recognition of the fact that the metallic filament lamp is not working marvels in bringing in new consumers. It is remarked that the replacement of carbon by metallic filament lamps has only been "slightly off-set" by the accession of new lighting consumers; and the fear has taken root that "some little time must elapse before the proportion of lighting to power units will increase." It is quite a change to have a reasonable recognition of the position.

THE LATE MR. JOHN ROMANS.

In the "JOURNAL" last week (p. 151), we recorded the death, in his 91st year, of Mr. John Romans, of Newton Grange, Dalkeith. The funeral took place last Wednesday, at Newbattle Churchyard, and was attended by a large number of mourners, including representatives from the Mid-Lothian County Council and various other public bodies. A correspondent has sent us a newspaper containing an account of deceased's life-work, from which we are able to amplify the few particulars already given.

Mr. Romans was born at Newbattle on March 1, 1819, and was educated in the parish school, and afterwards at a school in Dalkeith. He was brought up as a millwright with a firm in Loanhead; and on the completion of his apprenticeship he came to London, and was employed by Messrs. Hunter and English, at Bow. While working for them, circumstances, mainly arising from the active part he took in trade disputes (he was a Chartist and a Cobdenite), led him to decide on emigrating to Canada, where he had a prosperous relation who had sent him an invitation to go over. At that time, however, the Directors of the Commercial Gas Company, at whose works he had been erecting some machinery, engaged him as one of their engineering staff. While discharging the duties of his new position, he married the daughter of Mr. Thomas Samson, an accountant in the service of the East India Company. He remained in London till 1851, when he was appointed Engineer and Secretary of the Devonport Gas Company. During his residence in that town, he was successful in obtaining from the War Office and the Admiralty a grant to assist in the erection of a church and the provision of a clergyman for Scottish soldiers, sailors, and artizans.

In 1863, Mr. Romans returned to Edinburgh, and took an active part in the municipal affairs of the city; subsequently becoming a member of the Town Council. The subject of the acquisition of the water supply was then under consideration; and, after prolonged opposition, it was decided to purchase the works of the Water Company. The question then arose as to where the city should go for an additional supply. After personally surveying all the sources recommended, Mr. Romans considered St. Mary's Loch was by far the most suitable; and a Bill to sanction its appropriation was submitted to Parliament. It was passed by the House of Commons, but thrown out by the House of Lords. The municipal elections followed shortly after; and as it appeared to him that his views were not in harmony with those of the majority of the electors, he retired. During the time he was a member, he vigorously advocated the purchase of the undertaking of the Gas Company, which, as is well known to most of our readers, was accomplished in 1888.

In 1891, Mr. Romans, accompanied by one of his daughters, made a tour of Canada and the United States, where he delivered lectures, and was most hospitably entertained in all the cities he visited. He was a member of various societies in the Dalkeith district, and for a long time Chairman of the Newbattle School Board and representative in the Mid-Lothian County Council.

Sinking and Lining Shafts.—A method for sinking and lining shafts simultaneously is outlined in the contract drawings for some of the work of the Board of Water Supply of the City of New York in constructing the Catskill aqueduct. The scheme consists in suspending in the shaft a wooden lining platform, in the centre of which is a hole large enough to allow a "muck" bucket to pass through it. The full or empty buckets may be hoisted or lowered through the hole in the platform without interrupting the concreting operations.

Inverted Burner Anti-Vibrators.—In last week's issue (p. 158), illustrated reference was made to a new type of anti-vibrator for inverted burners which is being put upon the market by Messrs. J. & W. B. Smith, of Farringdon Road. The firm also draw our attention to a new pattern of anti-vibrator inverted burner pendant; the anti-vibrator in this case consisting of a coil spring (to the top and bottom of which the gas-supply pipe and the pendant respectively are attached) and a flexible tube connection. This is an attractive looking, inexpensive, and very useful fitting, suitable for all positions where much vibration and severe shocks are to be anticipated.

GAS BILLS FOR 1910.

[FOURTH ARTICLE.]

THE review of the Bills promoted by Statutory Gas Companies is concluded this week, and a commencement is made with those promoted by Local Authorities.

The Bill deposited by the Exmouth Gas Company is mainly a financial one. From the preamble, it is gathered that the existing share capital of the concern is made up of £3600 ordinary £10 shares (1865 Act) entitled to a dividend of 10 per cent., £3000 ordinary £10 shares (1865 Act) entitled to a dividend of 7 per cent., £4000 ordinary £10 shares (1882 Act) entitled to a dividend of 7 per cent., and £12,200 preference £10 shares (1882 Act) entitled to a dividend of 5 per cent. The premiums upon the sale of shares amount to £1742 10s. in respect of the ordinary shares and to £2790 7s. 6d. in respect of the preference shares. Under the 1865 Act, the Company have borrowed £1650, entitled to interest at the rate of 5 per cent.; and under the Act of 1882, they have borrowed £5000, entitled to a dividend of 4 per cent. Turning to the clauses of the Bill, it is seen that the Company desire to extend the limits of supply, so as to include the parishes of Lympstone and Woodbury. Certain plots of land are scheduled which the Company need for manufacturing purposes. It is intended to convert the existing ordinary and preference capital on a 5 per cent. basis; and additional capital powers are sought to the extent of £24,000, of which not more than £16,000 is proposed to be raised by way of preference stock. To the issue of the additional capital, the new auction clauses are to apply. The Company ask for sanction to borrow, inclusive of the sum of £6650 already raised, £9000 in respect of the consolidated ordinary and preference stocks, and in respect of the additional capital up to one-third. The sliding-scale provisions of the Act of 1882 are to be amended on the ordinary lines, to comply with the altered conditions through the conversion to 5 per cent. stock. Power is to be taken to form a special purposes fund. The prescribed illuminating power of the gas supply is proposed at 14 candles, tested by a No. 2 "Metropolitan" burner. A stand-by clause is inserted to meet the cases of consumers having private supplies. The ordinary prepayment clause appears. It is also contemplated that, after the passing of the Bill, the Company shall not be liable to forfeiture by reason of the presence in the gas of sulphur compounds other than sulphuretted hydrogen. [*Parliamentary Agents: Messrs. Torr and Co.*]

The terms of the three Bills promoted, under the auspices of the Gas Companies' Protection Association, and dealing with the joint application regarding the adoption of the "Metropolitan" No. 2 test-burner, were dealt with in the "JOURNAL" for Dec. 21, p. 823. The names of the Companies joining in the promotion were published on Nov. 23, p. 548. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

In principal part, the Bill promoted by the Great Grimsby Gas Company is for capital purposes; but opportunity is taken to secure several currently customary powers. It is requested that the limits of supply may be extended, in order to include the parishes or townships of Ulceby, North Killingholme, and South Killingholme, and the parishes of Aylesby, Habrough, Healing, Immingham, and Stallingborough. Within this extended area, the Company desire to be empowered to charge 6d. per 1000 feet in excess of the price for the time being within the present limits of supply; but any sum so charged is not to be taken into account in calculating the rate of dividend payable under existing powers. The Company ask for authority to create and issue additional capital to the amount of £120,000, of which not more than £40,000 is to be raised as preference shares or stock. The new auction and tender clauses are to apply to the additional capital. Borrowing powers to the extent of one-third of the additional capital are desired. The Company seek to adjust their reserve fund powers on modern lines, and form a special purposes fund. Land is scheduled which the Company wish to utilize for the storage of gas and residuals. In regard to the gas supplied, it is proposed that the prescribed illuminating power shall be 14 candles, tested by the "Metropolitan" No. 2 burner. A stand-by clause is inserted for the protection of the Company in respect of gas consumers with private installations. Power is desired by the Board to appoint one or more members of their body to be Managing Director or Directors of the Company, in terms similar to those included in the Bristol Bill (noticed last week). They also request to be invested with the right to determine the salary of the Secretary. Concerning the Auditors, it is proposed to enact that, as from Jan. 1 next, no person shall be appointed as an Auditor of the accounts who is not either a chartered accountant or an incorporated accountant; and it will not be necessary for such person to be a shareholder. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Mainly for the purpose of extending their limits of supply, the Shirebrook and District Gas Company are approaching Parliament. It appears, from the preamble of the Bill before us, that the Mansfield Improvement Commissioners (now Corporation) were, by their Gas Act of 1878, empowered, *inter alia*, to supply gas within the whole parish of Warsop; but there has been no exercise of the powers. Further by the Bolsover Gas Order of 1894, the Bolsover Gaslight and Coke Company, Limited, were authorized to supply gas within the parish of Bolsover; but there are portions of the parish still unsupplied. It is desired that the existing powers in regard to Warsop and the unsupplied parts of

Bolsover be repealed, and that the limits of supply of the promoting Company be extended, in the county of Nottingham, to the parishes of Cuckney and Norton, and the remainder of the parish of Warsop not already included in the area of supply of the Company as defined by the Act of 1899; and in the county of Derby, to specified portions of the parish of Bolsover. [*Parliamentary Agents: Messrs. Crowders, Vizard, Oldham, and Co.*]

Coming now to the Bills promoted by Local Authorities, there are in all eleven which refer to gas in whole or in part.

Taking them in alphabetical order, the first is the Bill of the Bishop's Stortford District Council. It is a purchase measure; and (had the Council not themselves discarded it, as reported last week) its chief interest would have rested in the fact that it conflicts with the scheme for the fusion of certain Essex Companies as noticed in our first article on Bills for the session (*ante*, p. 23). Before the abandonment of the Bill was resolved upon, the following indication of the principal provisions had been drafted. The preamble of the measure recites that the Bishop's Stortford and District Gas Company were, by an Act passed in 1904, incorporated and authorized to supply gas within the urban district of Bishop's Stortford and certain adjoining parishes. The issued ordinary and preference capital (including £771 17s. 6d. premiums) amount to £35,391 17s. 6d.; and there has also been borrowed £11,400. The Council believed it was now expedient they should be authorized to acquire the Company's undertaking. They also took the opportunity of asking that the period prescribed by their Electric Lighting Order within which they are to supply electrical energy should be extended, and that additional electrical powers should be conferred upon them. Examining the clauses of the Bill, it is seen that the Council required to purchase the undertaking either by agreement or arbitration under the Lands Clauses Acts; and there followed all the customary clauses affecting transfer and the conduct of the business. Succeeding were the clauses to confer on the Council the powers of gas manufacturers and suppliers. The price of gas was proposed to be limited to 4s. per 1000 cubic feet; and the excess charges for prepayment supply beyond the ruling ordinary ones were on the usual lines. The illuminating quality of the gas was to be prescribed at 14 candles, as tested by the "Metropolitan" No. 2 burner. The Council requested power to borrow money necessary for the purchase of the works together with the cost of the Act, and such other money as might from time to time be required, under the sanction of the Local Government Board. The period asked for within which to repay the purchase money was 45 years. [*Parliamentary Agents: Messrs. Baker and Co.*]

In an Omnibus Bill, the Bradford Corporation seek for the confirmation of an agreement dated Dec. 19, 1907, made between Henry Ripley, Hugh Ripley, and Edward Guy Ripley, as Trustees under the will of the late Sir Henry William Ripley, of the one part and the Corporation of the other part. The agreement is set out as a schedule to the Bill. Under it, it is seen that the Corporation are purchasing the private gas-works in possession of the Trustees, and situated at Ludlam Street, for the price of £15,000. Stocks of coal, coke, gas, liquor, &c., are to be taken over on a valuation by Mr. Alfred E. Grainger and Mr. Charles Wood, the Corporation Gas Engineer; and in the event of disagreement, they will have power to choose a third person. The Corporation ask for the necessary borrowing powers to give effect to the agreement; the money to be repayable in a period not exceeding twenty years. In regard to electricity supply, the Corporation desire power to attach, with the consent of the owner, to any building, brackets, wires, and apparatus as required for street lighting. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Egremont District Council are proposing the purchase of the undertaking of the Egremont Gas Company, under an agreement already entered into. The Cleator Moor District Council have powers of, and do, supply in certain portions of Egremont; and the Whitehaven Rural District Council have also mains in other parts. These mains the Council desire to acquire. The preamble also states that estimates have been made of money requirements beyond those for purchase. They are: For new works and extensions, £3700; for the construction of a new road, £100; for the purchase of cookers, engines, stoves, and meters, such sum as may be required from time to time not exceeding £500; and for the construction of further works, as necessary, a sum not exceeding £10,000. The agreement between the Council and the Company is dated Nov. 2 last; and it shows that the consideration for the sale is to be the payment by the Council of the sum of £6500, and also of such amount as shall be agreed upon, or in default of agreement fixed by arbitration, as the price of the coal, coke, gas, lime, and residuals. The Bill provides for the confirmation of this agreement; and there follow all the usual essential clauses relating to transfers and winding-up. Provision is also made for the purchase of the gas-mains of the Cleator Moor Council in the Egremont Council's territory—the price to be decided, failing agreement, by a single arbitrator appointed by the Local Government Board. If the power is granted, the rights of supply of the Cleator Moor Council in the district are to be repealed. Similar clauses appear in relation to the mains of the Whitehaven Rural District Council in the parish of St. John Beckermet. For the purposes of the undertaking and the construction of a new road, the Council desire compulsory powers of purchase over certain specified lands. The ordinary prepayment clause is included. The price of gas is limited to 5s. 6d. per 1000 cubic feet. As to discounts, the old 10 and 15 per cent. clause is inserted. The illuminating quality of the gas is proposed at 14 candles, tested by the "Metropolitan" No. 2 burner. Authorization to borrowing the money required is asked, with repayment in thirty years of money spent in purchase, new works, and extensions; in forty years for lands; in ten years for cookers, engines, stoves, and meters; in five years for the costs of the Act. [*Parliamentary Agents: Messrs. Hargreaves and Crowthers.*]

The Hoyland Nether District Council were coming for confirmation to an agreed transfer of the undertaking of the Elsecar, Wentworth, and Hoyland Gas Company, and for powers of supply; but, as reported last week, the ratepayers have rejected the scheme. Prior to this, the following reference to the provisions of the Bill had been prepared: The limits of supply were Wentworth, so much of Brampton-Bierlow as is not included in the area of the Wath-upon-Dearne and District Gas Order, part of Worsbrough, and Tankersley. The terms of transfer were: The payment of £27,000, and of the amount which the Company, with the consent of the Council, might expend on capital account between Nov. 30, 1909, and Dec. 31, 1910, together with the determined value of the consumable stock. The purchase was to be completed on Dec. 31 next. All necessary provision in regard to transfer and winding-up was made in the Bill. It was also stipulated that, on the transfer, the Council should take into their employ Albert Frank Hall and William Stenton, being respectively the Secretary and Manager of the Company, for a period of at least three years, and otherwise upon terms and conditions of service substantially the same as those on which they were respectively employed by the Company on Nov. 30 last, provided that they first entered into an agreement to faithfully and efficiently serve the Council for the period named. Following were clauses containing powers essential to the conduct of the business by the Council. The Council desired that they and the Earl FitzWilliam might enter into agreements for the purchase and sale, or lease, of the gas-works lands. In connection with the fittings clause, the provision was inserted as to the adjustment of the charges in such manner so as to meet outgoings. The prepayment clause was in ordinary form. The limit of the price of gas was proposed at 5s. 10d. per 1000 cubic feet, for a prescribed 14-candle gas, tested by the "Metropolitan" No. 2 burner. Open power was contemplated in regard to the terms and conditions on which, under agreement, other authorities might be supplied with gas for public purposes. Authorization to the borrowing of the purchase money was desired, as well as to a sum not exceeding £8000 for the extension and improvement of the works—the respective repayment periods being proposed at 40 and 30 years. [*Parliamentary Agents: Messrs. Durnford and Co.*]

The New Society of Engineers.

There was a large and distinguished gathering, which included a number of ladies, at the Waldorf Hotel last Wednesday evening, on the occasion of the dinner held, in accordance with the announcement previously made in the "JOURNAL," to celebrate the amalgamation of the Society of Engineers and the Civil and Mechanical Engineers' Society. Mr. E. J. Silcock, M.Inst.C.E., and Mr. W. N. Twelvetrees, M.I.Mech.E., Presidents of the two Societies, occupied respectively the chair and the vice-chair. Mr. Silcock, in proposing "The New Society," remarked that though the two organizations constituting it had for more than half-a-century been running on parallel lines, with similar objects and in very friendly relationship, it was not until after the death of the Secretary of his Society, Mr. Perry F. Nursey, and the appointment as his successor of the Hon. Secretary of the other Society (Mr. A. E. E. Ackermann, B.Sc.), that, owing largely to his good offices, an *entente cordiale* had been established, and an amalgamation of the two Societies was eventually brought about. He expressed the hope that by this union the usefulness of both might be increased. Mr. Silcock briefly sketched the history of the Society of Engineers; and Mr. Twelvetrees, in supporting the toast, gave some particulars as to the origin and work of the body he represented. He mentioned that the combined membership was 750. The President of the new Society (Mr. Diogo A. Symons, M.Inst.C.E.), who was temporarily absent, expressed through Mr. Ackermann his gratification that the amalgamation had taken place. After the speeches coffee was served; and the performance of a selection of vocal music brought to a close a very pleasant evening.

Natural Gas, Coal, and Petroleum in Canada.—It appears from a report which has been issued by the Canada Department of Mines that the production of natural gas is greatly on the increase. In 1907, the total value of the production was £163,000, an increase of 39·7 per cent. as compared with 1906; whereas in 1908 the production reached a value of about £202,550—this figure being by far the largest ever recorded, and showing an increase of 24·2 per cent. as compared with 1907. In 1908, the gas was produced entirely by the provinces of Ontario and Alberta. The production of coal in the two years named was respectively 10,511,426 and 10,886,311 tons, against 9,762,601 tons in 1906; about one-eighth of this being made into coke. The figures relating to petroleum show a decrease of nearly 33 per cent. for 1908 as compared with 1907; the actual production in the two years being 527,987 and 788,872 barrels, each containing 35 gallons.

PERSONAL.

Herr RICHARD PINTSCH, the head of the firm of Julius Pintsch, of Berlin, with its affiliated businesses in London and Vienna, has had the honorary degree of Doctor of Engineering conferred upon him by the Technical College of Berlin, in recognition of his eminent services in gas lighting, especially in connection with railway carriages and buoys.

In succession to Mr. A. CLEMENT HOVEY, who some time ago tendered his resignation, but continued to occupy the position pending the selection of a successor, Mr. E. P. STEVENSON has been appointed Engineer of the Milan works of the Continental Union Gas Company. Mr. Stevenson is a son of the late Mr. G. Ernest Stevenson, who was Gas Engineer to the Manchester Corporation; and his most recent engagement has been at the Belgrano works of the River Plate Gas Company.

Rather more than two years ago, Mr. R. ST. GEORGE MOORE, M.Inst.C.E., who was then President of the Society of Engineers, left England to fulfil an important professional engagement in China. It comprised the construction of the Hankow Water-Works, and the supervision, as Engineer-in-Chief, of the carrying out of the Hupeh section of the Canton-Hankow Railway. The water-works having been completed, and Mr. Moore's agreement with respect to the railway terminated, he is returning to England, and is expected to arrive next month.

OBITUARY.

We regret to record the sudden death on Wednesday last, at Groveside, Teddington, at the age of 72, of Mr. JOSEPH QUICK, the well-known water engineer. According to some particulars contained in the current number of "Engineering," Mr. Quick early in life passed through a course of study specially arranged to prepare him for the profession of a civil engineer; and in 1853 he entered the office of his father, who was then prominently known in connection with the construction of water-works. Next year the son was sent to the Berlin Water-Works, which were then being constructed by Messrs. Aird. Returning to England, he entered his father's office, and was occupied on the new works of the Grand Junction Water Company at Campden Hill, Kensington, and at Kew, as well as on the Hampton and Battersea works of the Southwark and Vauxhall Water Company. In 1858, he became Assistant-Engineer to the latter Company, but at the same time was permitted to practise on his own account. In this way he was able to give the advantage of his experience to many companies and communities owning water-works. In 1863, he became a partner with his father, and, in conjunction with him, carried out many extensive works, not only for the two London Companies already named, but at Portsmouth, Amsterdam, and elsewhere. He retired some years ago; but the firm of which he was the head are still the Consulting Engineers of the Portsmouth Water-Works Company. Mr. Quick was elected a member of the Institution of Civil Engineers in 1870.

Gas for Store Lighting.—At the last annual meeting of the American Commercial Gas Association, Mr. R. R. Young read a paper on "The Future of Gas for Store Lighting," in the course of which he said: "The correct way theoretically to light a store is to have the regular inverted incandescent gas-lamp fitted with the proper diffusing shade placed in single units over the counter, spaced and hung so as to have the light evenly distributed; but experience has taught us that, with stores of the usual width of 18 to 20 feet, the larger units of the inverted type of fixtures, such as the reflexolier fitted with the proper shades, and the inverted arc lamp, are far more satisfactory to the customer. In the case of the larger units, we reduce the number of parts to be taken care of, such as glassware, where there is one globe with the arc as against eight or ten pieces of glassware, to the single lamps, and one pull instead of four or five when lighting, and only one pilot-light to look after. The installation is more convenient to light and extinguish, and at the same time meets one of the arguments advanced by the electric solicitor for his wares—that of convenience."

Frankfort Gas Supply.—It is announced by the "Journal für Gasbeleuchtung" that the amalgamation which was arranged last year between the Frankfort Gas Company and the local works of the Imperial Continental Gas Association has involved a re-arrangement of the staffs of the respective works at Frankfort-on-the-Maine. Herr Karl Kohn, who was Manager of the old Frankfort Gas Company, retires by his own desire from management, but places his services in an advisory capacity at the disposal of the new joint Company. The management of the latter will be in the hands of Mr. William W. Drory, "the senior of the German gas industry," and Herr Ludwig Schiele, the son of the departed "Nestor" of that industry. The Board of Management will be under the chairmanship of Herr L. Delbrück, a banker and member of the House of Representatives. The new Company will work the two gas-works of the Imperial Continental Gas Association on the Ober-Main Quay and at Bockenheim, as well as the Gutlentstrasse works of the Old Frankfort Gas Company. A new gas-works is, however, shortly to be erected on the Osthafen, and equipped with all modern apparatus.

STATISTICS OF WORKMEN'S COMPENSATION.

THERE were noticed in last week's issue of the "JOURNAL" some of the principal points from the first part of the Home Office Blue-Book for 1908 on the Workmen's Compensation and Employers' Liability Acts. These, however, dealt only with statistics of compensation under the newest Act (that passed in 1906) in cases occurring in certain specified industries. Part II. of the Blue-Book furnishes the customary information with regard to the general administration of the different Acts; and from this portion some figures may, as usual, now be extracted. The matters referred to in this part of the returns are: Cases coming for arbitration before the County (in Scotland, the Sheriff) Courts; those in which memoranda recording agreements or awards by committees or private arbitrators under the Workmen's Compensation Acts are registered in the County or Sheriff Courts; those under the Employers' Liability Act of 1880; those taken to the Appeal Courts; and the use made of the services of Medical Referees. The "contracting-out" schemes certified by the Chief Registrar of Friendly Societies are set forth in the annual report dealing with Friendly Societies; and an opportunity may be taken next week of making some brief reference to them. The part of the Home Office compensation statistics now under review is divided into three sections, covering respectively England and Wales, Scotland, and Ireland.

Taking first England and Wales, it is found that in 1908 the number of cases actually dealt with under the Workmen's Compensation Act of 1906, by County Court Judges and by County Court Arbitrators was 3795; and of these 3602 were decided by Judges, and 47 by Special Arbitrators, while 146 were settled by acceptance of money paid into Court. In addition to the cases adjudicated on, there were 1563 that were withdrawn, settled out of Court, or otherwise disposed of in such a way as not to enable the officials of the Court to state definitely the results. This makes the total number of cases taken into Court, under the 1906 Act, 5358—as against 3330 in 1907, and 2532 in 1906, under the earlier Acts. In 96 of the cases last year compensation was claimed for incapacity due to industrial disease. With regard to the decisions come to, it may be remarked that of the claims settled within the cognizance of the Courts, the decision in 2050 cases was in favour of the applicant, and in 453 in favour of the respondent. Thus the proportion of successful claims was 82 per cent., which compares with 84 per cent. in 1907, and 83 per cent. in 1906. The number of cases in which compensation was awarded (under the 1906 Act) on account of the death of workmen leaving dependants was 772, in addition to 30 cases under the earlier Acts; the corresponding figure for 1907 having been 537, and that for 1899 (the first complete year during which the first Compensation Act was in operation) 219. The total amount of compensation awarded last year in the 772 cases of death in which the deceased left dependants was £128,340, or an average of £166 per case. The total sum involved in the 30 cases under the earlier Acts was £4004, or an average of £133 per case. These figures compare with £174 9s. and £180 12s. 8d. respectively for the previous year. The average figures for the last five complete years under the earlier Acts (exclusive of the few cases in which the deceased left no dependants) were: Number of cases, 426; total compensation, £78,097; average compensation, £183. Of the 772 cases settled last year in which compensation was awarded to dependants under the Act of 1906, there were 268 in which sums of less than £150 were awarded (cases of partial dependency); the total amount being £18,275, or an average of £68 3s. 10d. per case.

With regard to the cases of injury, the assignment of a weekly sum was the most general method of compensation adopted; there having been, under the 1906 Act, 1009 cases in which a weekly payment was fixed, as compared with 263 in which the compensation was returned as consisting of a lump sum. In 33 of the cases in which a lump sum was paid, the claimants accepted amounts paid into Court; while in most of the remaining instances, a lump sum was apparently awarded by consent of the parties. The average amount of the compensation was £24 17s. 6d.; whereas the average figures for the last five complete years under the earlier Acts were: Number of cases, 113; average amount of compensation, £34. In the instances last year in which a weekly payment was awarded, the average compensation was for cases of total incapacity 12s. 9d., and partial incapacity 10s. 4d. per week. Under the Acts of 1897 and 1900, there were seven classes of employment included—railway, factory, mine, quarry, engineering work, building (part only), and agriculture; but the cases which were taken into Court last year, within the much wider basis of the 1906 Act, are classified under no less than seventeen heads, the grouping of occupations being as far as possible that adopted in the Census returns. It may be of interest to reproduce the list and the number of cases taken into Court during 1908 under each head: Professional employments, 19; commercial occupations, 19; shop assistants, 121; domestic servants, 368; seamen, 326; fishermen, 17; agriculture, 284; building, 543; factories and workshops, 1440; docks, wharves, and quays, 275; mines, 1057; quarries, 66; constructional work (excluding building), 129; railways, 250; inland transport by road, 362; inland transport by water, 29; miscellaneous, 53. These figures are eloquent.

Instances in which memoranda were registered in County

Courts, having reference to cases settled by agreement or private arbitration, form the subject of the next table. The number on the present occasion shows a very large increase over preceding years. This is attributed partly to the much wider scope of the new Act, but mainly to the provisions therein for enforcing registration. The number, however, it is stated, is only a small proportion of the cases in which compensation is settled by agreement. According to the table, the registrations under the 1906 Act of cases settled were: By agreement, 20,414; by committee of employers and employed, 164; by an arbitrator, 2. The corresponding figures for the last complete year under the earlier Acts were 5096, 68, and 7. In these agreed cases in 1908, the average compensation to dependants in connection with fatal accidents was £169; and the average weekly payment in cases of incapacity, 13s. 3d. For the last five complete years under the earlier Acts, the average payment in the event of death was £160; and in cases of incapacity, 13s. 1d. per week. The number of accidents involving incapacity under the Act of 1906 in which the memorandum registered was for a lump sum and not a weekly payment, was 10,201, as compared with 5964 cases in which a weekly payment was agreed upon. The average lump-sum payment over the 10,201 cases was £18 19s. 2d.; but the figures under the different classes of employment show wide variation. It would seem that the accidents in connection with docks, wharves, and quays were generally of the least serious character, as the average lump sum commutation in this section was no more than £12 15s. 5d. Next in order are domestic servants, £13 2s. 11d.; and then agriculture, with £13 17s. 7d. The highest average is in the case of mines (£34 4s. 3d.), quarries (£28 4s. 11d.), and railways (£28 4s. 3d.). Factories and workshops, under which are classed 4079 of the 10,201 cases of commutation, have an average of £19 7s. 6d.

Now we come to the Employers' Liability Act of 1880, which is dealt with in the report upon as nearly as possible the same lines as the Compensation Act, but in a simpler fashion—owing to the facts that all cases except those removed to the High Court are decided by the County Court (there being no arbitrators), and that the damages awarded can always be stated as a lump sum. Since the passing of the first Compensation Act, there has been a continuous falling off in the number of actions brought under the Employers' Liability Act. The figures were: 1897, 688; 1907, 393; 1908, 260. Of last year's actions, 67 ended in judgment for the plaintiff, 45 in favour of the defendant, and 148, or more than 50 per cent., were "otherwise disposed of." The total amount of damages awarded was £4535. Of the 67 cases in which judgment was given for the plaintiff, only two related to fatal accidents; the total compensation awarded being £406. There were 31 cases of total incapacity, with compensation of £2042, or an average of £66 a case; and 34 of partial incapacity, with total compensation of £2087, or an average of £61 per case. The average amount of damages recovered last year in case of death under the Employers' Liability Act was thus £203, compared with £165 under the Compensation Acts. To proceed under the former Act is, however, apparently more expensive; the average amount of solicitor's costs having been £23 13s. 5d. under the Employers' Liability Act, and £11 2s. 10d. under the Workmen's Compensation Acts.

In England, during 1908, the number of actions under the Compensation Acts carried to the Court of Appeal was 112. which was just below 2 per cent. of the cases that came before the County Courts. Of these, 47 were appeals by workmen, and 65 by employers. Of the former, 11 were successful, and of the latter 28; while 20 appeals were abandoned, withdrawn, or else settled out of Court before the hearing. There were three appeals to the House of Lords—all unsuccessful; the workman being the appellant in one case. There were five appeals under the Employers' Liability Act; but of these only one (which was by a workman) was successful. One appeal to the House of Lords under the Compensation Act of 1897 turned on the meaning of the words "accident arising out of, and in course of, the employment;" another under the Act of 1906, upon the definition of the word "accident." Of the 112 cases carried to the Court of Appeal, five were in reference to the definition of the term "average weekly earnings," and no less than eighteen to the meaning of the words "arising out of, and in the course of, the employment." In several more, the point was the definition of either the word "factory" or the word "workman."

Dealing with the Scottish returns, it is stated in the report that during 1908 the number of cases taken into Court under the Compensation Acts was 1026 (compared with 417 in the previous year); and under the Employers' Liability Act, 140. The average amount of compensation paid in case of death where dependants were left was £144 15s. 10d. in cases decided in the Sheriffs' Courts under the Compensation Acts, and £184 15s. 5d. where memoranda were registered. In cases of incapacity, the lump-sum figures were respectively £18 1s. 7d. and £16 4s. 9d., and the weekly payments 13s. 10d. and 13s. 5d. In Ireland last year there were 718 cases taken under the Workmen's Compensation Acts, and five under the Employers' Liability Act. The average amount of compensation in cases of death where dependants were left was £139 16s. 8d. when decided in the County Courts under the Compensation Acts, and £156 4s. 1d. where memoranda were registered. In connection with claims for accidents causing incapacity, the lump-sum figures that were awarded were respectively £34 2s. 2d. and £32 15s. 5d., and the weekly payments were 9s. 2d. and 11s. 6d.

MUNICIPAL INCOME AND EXPENDITURE.

Statistics from the Annual Local Taxation Returns.

THERE has just been published in the form of a Blue-Book Part V. of the Annual Local Taxation Returns, dealing with the accounts of the Councils of Boroughs other than Metropolitan Boroughs for the year 1906-7. It is needful, as usual, to lay special stress upon the period to which the figures refer, as they are, of course, by this time somewhat out-of-date. Presumably, however, the work entailed in the compilation of the returns is too heavy to permit of earlier publication—seeing that the date of issue is just about the same as was the case last year—and so the best that can must be made of them.

The number of boroughs in existence at the end of the year 1906-7, excluding the City of London and the Metropolitan Boroughs constituted under the provisions of the Local Government Act of 1899, was 326, of which 72 were county boroughs. The receipts (including transfers from one account to another), other than from loans, which are shown in the abstract of the accounts of borough councils for the year 1906-7, not being the exchequer contribution accounts of county boroughs, nor accounts relating to tramway, light railway, or water, gas, or electricity supply undertakings, amounted in the aggregate to £33,206,954. Of this sum, £18,861,607 was from rates; £27,895, the grant under the Agricultural Rates Act, 1896; £1,072,745, sums transferred to relief of rates from accounts relating to tramways and light railways and water, gas, and electricity undertakings; and £5,725,646, on account of education. The expenditure (exclusive of that defrayed out of loans, and of exchequer contribution accounts and accounts relating to tramway, light railway, water, gas, or electricity undertakings), including money passing from one account to another of the same corporation, amounted to £32,596,189, including £9,990,701 spent on account of education. Some of the principal items here were: Public roads and streets £5,042,989; sewerage and sewage disposal, £2,225,965; public lighting (including expenditure on public electric lighting not represented by loan charges), £1,188,490; police (not including payments out of police pension funds), £1,587,018; scavenging, £1,206,539; salaries, &c., and superannuation allowances of officers, and certain establishment charges, £1,386,263. There was also a sum of £318,807 transferred to make up deficiencies in revenue on account of tramway, light railway, gas (£795), water, and electricity undertakings.

The expenditure during the year by the councils which was charged, or was intended ultimately to be charged, to loan accounts, excluding expenses in respect of the undertakings just mentioned, amounted to £4,922,168. The individual headings were: Education; public roads and streets; sewerage and sewage disposal works; harbours, piers, docks, &c.; housing of the working classes; public offices and buildings; parks and open spaces; lunatic asylums; hospitals; bridges and ferries; baths, washhouses, and open bathing establishments; depôts, stables, wharves, yards, and refuse destructors; other purposes. The total amount of loans actually raised during the year, excluding tramway, railway, water, gas, and electricity undertakings, and money borrowed under the Education (Provision of Working Balances) Act, 1903, was £5,421,185; while the repayments of principal and redemption of stock or annuities, and the total sum paid for interest, was £7,442,059. The amount outstanding at the close of the year under review in respect of the loans owing by councils (excluding tramway, &c., undertakings, but including education) was £122,764,730. Of this, £27,466,538 was for public roads and streets, £20,272,714 for sewerage and sewage disposal works, and £18,734,580 for education. The sums standing to the credit of sinking funds, loan funds, and redemption funds in connection with such of the outstanding loans of the councils as were repayable by means of such funds amounted at the close of the year to £7,880,500 in the case of county boroughs, and £1,440,009 in that of non-county boroughs.

Attention may now be given to the statistics with regard to accounts of councils in connection with the undertakings excluded from the figures already quoted—namely, tramway, light railway, and water, gas, and electricity undertakings. The receipts for the year 1906-7 (excluding sums withdrawn from reserve, &c., funds, and amounts transferred from other accounts to make up deficiencies in revenue), other than from loans, and the expenditure not defrayed out of loans, in the different branches, were as follows: Tramways and light railways—Receipts, including £35,627 received from other accounts of the councils, £5,522,555; and expenditure, including loan charges, £5,040,720. Water undertakings—Receipts, including £166,251 received from other accounts of the councils, £4,032,214; and expenditure, including loan charges, £4,150,378. Gas undertakings—Receipts, including £479,968 received from other accounts of the councils, £6,712,062; and expenditure, including loan charges, £6,039,243. Electricity undertakings—Receipts, including £1,012,544 received from other accounts of the councils, £3,302,576; and expenditure, including loan charges, £3,130,082. This gives a total income for the four classes of undertakings of £19,569,407; and an expenditure of £18,360,423. It should be noted that the expenditure excludes sums paid to reserve, &c., funds, and amounts transferred in relief of rates, or to meet deficiency in revenue of another undertaking; but expenditure out of sums withdrawn from reserve, &c., funds is included.

The total amounts expended by the councils out of loans (r

intended ultimately to be charged to loan account), and the total amount of loans raised by the councils, during the year under review, for the purposes of the four kinds of undertakings now being considered were: Tramways and light railways—Expenditure out of loans, £1,239,975; and receipts from loans, £901,373. Water undertakings—Expenditure out of loans, £1,517,299; and receipts, £1,516,179. Gas undertakings—Expenditure out of loans, £313,932; and receipts, £255,124. Electricity undertakings—Expenditure out of loans, £1,206,141; and receipts, £990,049. Thus the total expenditure out of loans was £4,277,347; the receipts were £3,662,725. The sum applied by the councils in the repayment of principal and the redemption of stock or annuities, in connection with loans raised for purposes of the undertakings referred to, was £2,049,104. The total expenditure (including interest and dividends) on account of loan charges was £6,590,970. The loans outstanding were: Tramways and light railways, £21,230,598; water, £60,083,232; gas, £19,499,723; electricity, £20,411,595—making a grand total of £121,225,148. The sums remaining in sinking funds, loan funds, and redemption funds at the end of the year, to provide for the repayment of outstanding loan debt, was £5,671,645. The reserve funds, depreciation funds, and insurance funds established in connection with the undertakings named, was at March 31, 1907, £3,335,568.

According to the Census of 1901 (after taking into account all alterations of area between that time and March 31, 1907), the total population of the 72 county boroughs was 9,622,799, and that of the 254 other boroughs was 4,295,684—making an aggregate of 13,918,483. The total rateable value of agricultural land and other property was £73,265,136. The rates raised during the year by councils of county boroughs averaged 5s. 7·5d. in the pound. In the case of the non-county boroughs, the average was 3s. 9·6d. in the pound where the councils were not the local education authorities, and 4s. 8·8d. where they were. The total amount raised was in the county boroughs £14,037,316; and in the non-county boroughs, £4,824,291.

It has been already stated that the total transfers from the accounts of tramway, light railway, and water, gas, and electricity concerns in aid of rates amounted to £1,072,745; while there were total transfers from borough, district, or other funds to make up deficiencies in the revenue of such undertakings to the extent of £318,807. The former amount was made up as follows: Tramways and light railways, £388,631; water, £102,448; gas, £490,767; electricity, £90,899. The deficiencies which had to be made good were: Tramways and light railways, £52,853; water-works, £238,361; gas, £795; electricity, £26,798. It will thus be seen that gas still remains far and away the most profitable, from a rate-aiding point of view, of the four classes of municipally managed undertakings referred to; for in addition to showing the greatest aggregate amount so transferred, it also exhibits a negligible deficiency to be made good, whereas the other three figure substantially in the last-named category.

Gas, therefore, occupying the premier position in this respect—as, of course, it does in others—it may fairly be dealt with first. Of the gas-works profits transferred in aid of the rates in the year under review, the several amounts over £10,000 were: Birkenhead, £11,050; Birmingham, £58,546; Blackpool, £15,081; Bolton, £20,000; Burnley, £11,778; Leeds, £15,273; Leicester, £34,159; Manchester, £60,000; Nottingham, £28,415; Rochdale, £17,693; Salford, £23,760; Southport, £13,000; Stockport, £13,000; and Warrington, £14,550. With regard to the electric light undertakings, picking out profits of £10,000 and over is once more a simple task. The only instances are Liverpool (£20,827) and Nottingham (£10,851). In the case of water-works, large profits are not to be anticipated; but Leeds comes out with £14,979.

On the point of losses, there is little to be said with regard to gas undertakings; the total amount involved being so absolutely trivial. At Morecambe, it is stated, a sum of £95 was transferred to meet a deficiency in revenue, and at Chard £700; these two instances making up the already-mentioned sum of £795 which represents the aggregate losses for the year 1906-7 on gas undertakings owned by the councils of county and non-county boroughs. Gas was supplied free to the public street-lamps at Oldham, Lancaster, Abergavenny, and Dewsbury; while at Colne part of the expenditure on street lighting was borne by the Gas Department. Deficiencies had to be met in the case of no less than twenty-nine electricity undertakings; but in only ten instances was the amount over £1000, and none of these exceeded £2000. Water-works always, in the nature of things, provide a numerous list of losses; but often they are only small. On the present occasion the sums over £10,000 are: Birmingham, £65,000; Halifax, £13,218; Huddersfield, £12,661; Swansea, £25,322; and Middlesbrough, £12,403.

In a recent number of the "Comptes Rendus," M. Meunier dealt with the subject of the incandescence of platinum in mixtures of coal gas and air. According to an abstract of the article in the "Journal of the Society of Chemical Industry," the author noticed, in the course of his experiments on the incandescence of platinum wires in the interior of a bunsen flame, that if the wire be perfectly clean, it no longer glows in the mixture of coal gas and air in the tube of the burner. When, however, the wire is passed between the fingers before being plunged into the gaseous mixture, incandescence is produced. Dipping the wire in ordinary drinking water also produces the same phenomenon; and the author comes to the conclusion that it is not the platinum itself but the saline substance upon it which causes incandescence.

MODERN COKING PRACTICE.*

THERE is much in this work by T. H. Byrom and J. E. Christopher which cannot fail to be both interesting and instructive to those whose experiences have been confined to gas-works. The book is well illustrated to the number of 109 plates, and covers a good deal of ground common to both industries. Chapters on the "Sampling and Valuation of Coal and Coke," "Cooling and Condensing Plant," "Gas-Exhausters," "Composition and Analysis of Ammoniacal Liquor," "Working-up of Ammoniacal Liquor," "Treatment of Waste Gases from Sulphate Plants," "Valuation of Ammonium Sulphate," all concern the gas engineer as much as they do his *confrère* of up-to-date coke-oven works.

The author commences by giving a short summary of the history of iron manufacture and allied industries, showing, by means of diagrams, the enormous increase in the production of pig iron since 1850. In that year, the world's output was only 4½ million tons; while in 1906, the output was no less than 60 million tons, of which Great Britain was responsible for 10 millions. This vast increase in the iron industry has been followed by an equally great development in the coke-oven industry, though, from the point of view of progress, it is somewhat unsatisfactory that no less than 80 per cent. of the coke is even now produced without recovery of the bye-products—representing, as the author points out, an annual loss of 220,000 tons of sulphate of ammonia and nearly a million tons of tar. This shows how great will be the competition gas-works will have to face in years to come.

The author passes on from a "General Classification of Fuels," in which he deals with the various impurities contained in coal, to a chapter on "Coal Washing," wherein we are introduced to six different types of machines, all of which are examples of inventive ingenuity. This is a subject which, without actually concerning the gas engineer, must yet appeal to his engineering instincts. Some gas coals contain a considerable amount of slaty material, for which they are earning an unenviable reputation; and it is conceivable that this useless matter will, in some cases, amount to fully 5 per cent., which, by means of the washing process, is all removable, and which, it may be pointed out, is equivalent to a loss of 500 cubic feet per ton. Further, this admixture of dross with the coal is a source of waste throughout the process, for its extra bulk must be paid for from the pit's mouth to the retort; and, again, it must be heated, thereby wasting fuel and reducing the capacity of the retorts; and, lastly, its presence in the coke to the extent of 7 or 8 per cent. seriously reduces the value of this fuel. This question of "Coal Washing," which is now a matter of importance to the coke-oven manager, may well eventually become one of moment to the gas engineer.

The calorific power of coal and coke, with a description of the best-known calorimeters, comes in for some consideration. Then follow three chapters on the various coke-ovens, from the beehive to the Collin. These chapters are excellently illustrated by photographs and reproductions from drawings, giving the reader a very good idea of the scientific development which has taken place in the construction of coke-oven plant. That this is considerable is proved by the fact that the production of coke per ton of coal has increased from about 58 per cent. to an average of about 66 per cent.; while the gas for disposal now amounts to nearly 60 per cent. of the entire production, as compared with a total loss in the beehive oven.

An interesting chapter is that on "Charging and Discharging Coke-Ovens." In up-to-date coke-oven practice, it is well known that the coal is first crushed in a disintegrator and is then compressed by stamping machines in a box of similar shape to the oven. It is then, while still in a compressed form, charged into the oven. The advantages of dealing with the coal in this manner are stated by the author to be: (1) Output is increased at least 10 per cent.; (2) denser coke; (3) the amount of coke breeze is reduced; (4) saving in labour; and (5) less wear on oven lining. The method of quenching the coke on its discharge is explained, as are also the means whereby undue breakage of the coke is prevented. This matter is not dealt with so fully as the importance of the subject warrants.

There is nothing in any way novel in the three chapters on "Cooling and Condensing Plant," "Gas Exhausters," and on the "Composition and Analysis of Ammoniacal Liquor," though the subjects are treated in an adequate manner. A good deal of consideration is given to the recovery of ammonia and the manufacture of ammonium sulphate. One or two types of saturators are described; while the question of the formation of blue and yellow salt is briefly discussed. A description is given of the Claus plant for sulphur recovery, and also the plant for manufacturing concentrated liquor, which latter process appears to obtain greater favour in coke-oven plants than in gas-works.

Chapter XVI., on the "Recovery of Ammonia Direct from Coke-Oven Gas," is a very interesting one, giving as it does descriptions and illustrations of three successful plants for the recovery of ammonia by means of an acid bath. More attention should be given to these processes in gas-works, eliminating as they do much unnecessary plant. In the first place, scrubbers are dispensed with, and the amount of cooling water is greatly reduced. Moreover, the two chief troubles of the sulphate plant—the purification of the waste gases and the disposal of the waste effluent—are by this means reduced very considerably, or

* "Modern Coking Practice." By T. H. Byrom and J. E. Christopher. London: Crosby Lockwood and Son; 1910.

are avoided altogether. The Otto-Hilgenstock patented method of sulphate manufacture would appear to be a perfect marvel of simplicity.

The author's concluding chapter, on the "Use of Surplus Gas from Coke-Ovens," includes a couple of illustrations of the Koppers and Collin types of inclined ovens, designed on the lines of gas-works practice. A brief description is also given of the plant erected at Bargoed by the Powell Duffryn Steam Coal Company, who have laid themselves out to provide a good gas-making as well as coke-making plant.

The best feature of the work is the excellence of the illustrations, greatly adding to the value of the descriptive matter, which is well and lucidly written. As the author points out, there is a prospect of a combination of coke-works and gas-works practice in the near future, whereby good, hard, metallurgical coke will be produced as well as gas suitable for lighting pur poses. It is this fact, which is undoubtedly true, that makes the book of special interest to gas engineers; and it certainly behoves them to become *au fait* of the methods of an allied industry.

WORKMEN'S COMPENSATION CASES.*

About a year ago,† we reviewed the first volume of the new series of "Butterworth's Workmen's Compensation Cases," and to-day we notice Vol. II. of that useful and instructive compilation of these important decisions under the Workmen's Compensation Act, 1906.

The volume under review is edited by his Honour Judge Ruegg, K.C., and Mr. Douglas Knocker, Barrister-at-Law. The arrangement of the reports has been changed, and, we think, improved. The cases here collected are those decided between September, 1908, and September, 1909. The decisions given in various County Courts are now properly relegated to the end of the book; while the judgments of the High Court, whether of England, Scotland, or Ireland are placed, as far as possible, in the order in which they interpret the successive sections of the Act. Thus, we begin with section 1; and the first authority (*Tomalin v. Pearson and Son, Limited*) defines the words of that section, "any employment," as not operative outside the confines of the United Kingdom. Then various decisions on the words "personal injury by accident" are given, and the difficulties of defining what is and what is not an "accident" are considered. Apparently, Lord Macnaghten's definition of it as some "unlooked-for or an untoward event which is not expected or designed" is generally approved. So, a rupture caused by tightening a nut with a spanner is an accident, though the workman was previously suffering from an aneurism; but cardiac breakdown through repeated excessive exertion is not an accident. Nor is paralysis caused by the long continued strain of the employment; for as Lord Justice Fletcher Moulton put it: "Waste over-running repair is not an accident" (*Walker v. Hockney Brothers*, p. 21).

Next are the cases which turn on the phrase "arising out of, and in the course of, the employment;" and some curious efforts on the part of applicants have been made to bring their accidents within the scope of these words. Following on, decisions under section 4 (1) relating to the liability of principals for accidents to workmen in the employ of sub-contractors, are dealt with; but no new principle seems to be involved. Similarly several other sections and points, as to agreements, payments, casual employment, &c., are interpreted and decided in this volume of collected cases.

The complete index to this and all previous volumes dealing with the same subject-matter greatly adds to its utility as a work of reference. We would suggest the possible advisability of still further classifying the cases, so that the Scotch and Irish decisions might be collected together, and each kept separate from those of the House of Lords or English Court of Appeal. To all interested in this important branch of our laws, this volume will prove a handy compilation and guide.

* "Butterworth's Workmen's Compensation Cases, Vol. II. (New Series). Containing Reports of Cases decided under the Workmen's Compensation Acts during the period September, 1908, to September, 1909." Edited by His Honour Judge Ruegg, K.C., and Douglas Knocker, Esq., Barrister-at-Law. London: Butterworth and Co.; 1910. [Price 7s. 6d. net.]

† See "Journal," Vol. CV., p. 521.

High-Pressure Gas Lighting in Paris.

In the course of a discussion which took place in the Paris Municipal Council on the 31st ult., a full report of which is given as a supplement to the current number of the "Journal des Usines à Gaz," it was stated that the Paris Gas Company are about to place some high-pressure lamps in certain prominent positions, in order to show how powerful a light may be obtained by means of gas. On the Boulevard des Italiens there will be 13 Graetzin lamps fitted with single burners of 1000-candle power; in the centre of the Place de la Concorde 12 "Pharos" lamps; in the Avenue des Champs Elysées 12 Keith lamps; and on the Boulevard du Grand Palais 10 "Soleil d'Or" lamps—all of 1000-candle power. In the headquarters of the Company, in the Rue Condorcet, there will be installed four Keith lamps, of the 1909 model, with inverted burners, of 1500-candle power; also two similar lamps, which will eventually be replaced by two lamps on the same system, but each of 4500-candle power.

HEATING AND VENTILATION OF BUILDINGS.

There was a crowded attendance of members of the Association of Engineers-in-Charge and invited guests at St. Bride's Institute, E.C., on Wednesday the 12th inst., when Mr. T. W. Aldwinckle, F.R.I.B.A., read an exhaustive paper on the "Heating and Ventilation of Public Buildings." The general subject, though of first-rate importance to his audience, is hardly one that need be dealt with fully here; but perhaps just a few points may be given from the paper as well as from the discussion which followed it.

At the outset, the author said that his aim would be to deal mainly with general principles; and he took ventilation first. He pointed out that the cubic space per head was not so important as might be imagined, so long as the requisite amount of fresh air was supplied without draughts and at a suitable temperature. A room might have a large cubic space per head; and yet, owing to imperfect ventilation, the amount of carbonic acid might be found to be unusually high. No rigid system could be successfully applied to all buildings alike. The nature of the building and the purposes for which it was intended must be separately considered in each case; and there were numerous methods of ventilation, both natural and mechanical, to select from. For rooms and offices open fireplaces were much preferable to radiators as a means of warming, as they were exhaust ventilators, and induced a current of air to flow in through open windows. As regarded staircases and corridors, radiators with open windows would be found quite sufficient. For a hospital ward, he suggested hot-water radiators, combined with a cheerful open fire. He regarded the Plenum system as unsuitable for the mechanical ventilation of a hospital ward; exhaust ventilation was more suitable. The warming and ventilation of churches and chapels were seldom satisfactory; and it was a good plan, whatever the warming apparatus might be, to keep it going constantly throughout the winter. One of the disadvantages of the exhaust system of ventilation was the risk of external air being drawn in through walls, chinks in windows, &c. In calculating the heating surface for warming buildings, allowance must be made for this cold air. This was a drawback from which the Plenum system was free.

The primary advantage of Plenum ventilation was that it put into the hall or room a specific and measurable quantity of fresh air, in specific positions, at definite and ascertained velocities, and at definite temperatures, and that this air could be filtered, moistened, and warmed at the main air-inlet. No other system admitted of these advantages. Its disadvantages were that as a rule long ducts were necessary for the distribution of the air, and that as the air had to travel a considerable distance along these ducts, the initial temperature as it left the heating battery was generally arranged somewhat high, in order to compensate for the cooling in the ducts. This caused a baking or drying of the air. It was when the Plenum system was coupled with auxiliary exhaust that he considered it most effective. The incoming air generally required some kind of filtration; and there should also be a good water spray to prevent drying of the air. He had used a filtering screen consisting of a large number of galvanized steel rods placed to break-joint about ¼-inch apart, all being removable. A water-trough was placed above these, from which water trickled down the rods.

The ventilation of factories was a subject by itself, as not only had the rooms to be warmed and ventilated, but noxious matters arising from many of the manufactures had to be separately removed, as near as possible at their point of origin, so as to prevent them from mixing with the general air of the room. As regards general ventilation, the majority of factories were content with open windows and skylights with steam heating; there being usually steam available. This was satisfactory, where there was a fairly large cubic space per worker. The Factory Act only required a cubic space of 250 feet per worker, except during overtime; and the inspectors would pass a maximum of 12 parts of carbonic acid in 10,000 during daylight, and 20 parts when gas was used as an illuminant. These were not very exacting standards. With a small cubic space mechanical ventilation was absolutely necessary; and satisfactory results had been attained in many factories where both Plenum and exhaust fans had been used. The removal of local impurities was, however, quite a different matter, and required special treatment.

Turning to methods of warming buildings, the author remarked that these would vary with the system of ventilation. With the simplest form of natural ventilation, they had the open fire—"that extravagant, much abused, but really cheerful and healthful method." For single rooms in a public building they were still the most comfortable and the most wholesome form of warming, and formed excellent extraction ventilators, provided always that there were suitable air inlets, or partially open windows. Leaving the subject of open fireplaces, they came to artificial warming; and the first method was direct heating by hot-water or steam radiators, which in some systems of natural ventilation took the place of open grates. Large improvements had been made in radiators. The heating surfaces had been better designed, and their efficiency thereby increased. Whenever possible, the radiators should be placed against an external wall, so that an air-channel could be formed at the back; and in all cases, whether against an inner or outer wall, a baffle should be fixed to the wall

immediately above the radiator, to prevent the deposit of blacks and dust on the wall above, caused by the convection air currents set up. It was preferable for the radiator to stand upon wall-brackets, and not on feet. Exposed or "direct" radiators heated both by radiation and convection, but principally by the latter; and the efficiency of the heating surface was considerably increased by fresh air currents passing across them. The freer the circulation of air round the surfaces of the radiator, the higher the efficiency; and for this reason low radiators were more effective than high ones, and single-column radiators than those with two or three columns. There should, therefore, be a good air-space between the loops. Ribs or other like extensions of the heating surfaces were of little value—at all events, in hot-water radiators. It was necessary to paint radiators; and it had been found that bright and glossy paints reduced the amount of radiation, and that a dull dark paint was preferable. The colour or brightness of the paint did not affect the convected heat.

On the author resuming his seat, the President (Mr. Henry Adams) remarked that the paper was so complete that it did not seem to lend itself very much to discussion. All the different systems had their advocates and their opponents; and he would define as a "successful installation" one about which there were no complaints. In America, they had had much greater opportunity than had been the case here to study the question; but they had had difficulties, one of which was in connection with scale in boilers, which caused a loss of power. Another trouble was sluggish circulation, due to friction in the pipes from scale, rust, sediment, &c., and possibly also to insufficient capacity at the beginning.

A discussion then ensued in which some eight or nine speakers took part; the first being the Hon. Secretary (Mr. Henry Capsey), who expressed disagreement with the simultaneous use of open fires and a hot-water system in a hospital ward. In fitting up hot-water systems, he said, mains and branches leading to radiators should be sufficiently covered, with a view to getting the greatest heat where it was most required. Mr. A. E. Wheeler pointed out that ventilation was a subject which in the past had not received the attention it deserved. The first object should be to provide a supply of air, and then have means of heating this air. There was one thing against open fires which all the discussion in the world would not remove. The author advocated admitting into the air any quantity of smoke; and yet he called the open fire a healthful method of heating. He might supply air to a building; but what about the smoke in the air that was so admitted? How could pure air be secured? If every radiator was fixed with a fresh-air inlet behind it, and sufficient openings were provided for the vitiated air to escape, nothing would be heard of stuffiness accompanying the use of radiators; but at the same time a chimney was a most efficient ventilator. Mr. Coleman inquired whether the author found a water spray efficient in removing all the dust and dirt from air. He thought a cotton wool filter was necessary, if it was desired to clean the air to any great extent. Mr. C. Adams thought that warming and ventilation appliances were difficult subjects to generalize upon. Every building ought to be considered on its own merits. The Plenum system of ventilation was adopted at the Birmingham General Hospital; and there was a very elaborate arrangement for moistening the air. He had heard of no complaints regarding this installation. Very little attention was given to the ventilation of dwellings, workshops, and similar places.

Electric heating was touched upon by Mr. A. E. Penn—just by way of seeing what members had to say about it. He quoted from the notice in "The Engineer" of the past year's progress, where it was stated that electric heating was being used to a greater extent; and the supply companies were giving somewhat better terms. A case had "been cited of an office, which is now heated by electricity for £2 10s. per annum, where the landlord used to charge £4 to £5 per annum for heating by steam." Mr. Maclean admitted that the Plenum system required attention, but thought it was so important that the requisite attention to make it a success should not be grudged. Referring to Mr. Penn's remarks, he said electric heating cost very much more than hot water. It had been stated by one authority to be more than twenty times as expensive. Mr. F. H. Broadbent expressed the opinion that now the electrical companies were bringing down their cost to 1d. or less per unit, electricity was going to be a formidable opponent of other systems of heating.

Replying to the discussion, Mr. Aldwinckle remarked that the great advantage of the open fire was that it formed a very powerful exhaust, and removed foul air just where it was very likely to be dangerous, which was 2 or 3 feet above the floor. When he spoke of open fires being healthy, he meant in relation to the occupants of the room. People outside must take care of themselves. He did not think the open fires in London would render the air injurious to health. A good many of the impurities in the air were disagreeable, but not harmful. With reference to electric heating, he did not go into this because he regarded it as being at present in its infancy—though he thought it would come on in time.

The proceedings concluded with hearty votes of thanks to the author and the Chairman.

The London and Southern District Junior Gas Association will hold the fourth meeting of the session at Cripplegate Institute next Friday. Mr. C. E. Rosevear, of Hythe, will submit some "Notes from Hythe;" and these will be followed by "Questions."

ESTIMATION OF FERROCYANIDES.

At the last Meeting of the Manchester Section of the Society of Chemical Industry, Dr. F. W. Skirrow read a rather long paper containing some laboratory notes on the estimation of ferrocyanides. Pending the publication of the paper in the Society's "Journal," we take from the "Chemical Trade Journal" the author's conclusions and a few notes of the discussion to which it gave rise.

In the Feld method for the estimation of ferrocyanide, some loss of hydrocyanic acid takes place on boiling the ferrocyanide solution with caustic soda with excess of magnesium chloride under the conditions of the test. A 99·5 per cent. yield of hydrocyanic acid may be obtained on distilling mercuric cyanide with sulphuric acid in presence of chlorides, if the concentration of the sulphuric acid be not allowed to become too great. If this distillation, however, be carried out in presence of the other products of the decomposition of the ferrocyanides which are present, a less yield than the above is obtained. Furthermore, it seems probable that under the conditions of the test the ferrocyanide is not completely converted into mercuric cyanide. In the zinc method for the estimation of ferrocyanide, it is advantageous to use much more concentrated solutions of ferrocyanide and zinc sulphate than those generally adopted. With the more concentrated solutions, a sharper end-point is obtained; and the effect on the presence of excess of alkali sulphate is minimized. In the estimation of ferrocyanide in the extractions obtained by extracting spent oxide of iron with carbon bisulphide, it is shown that high results are obtained if the solution be boiled and filtered before proceeding with the estimation. Lastly, caustic soda does not extract the whole of the blue from the oxide; there being some ferrocyanide residue and blue which is with difficulty soluble in caustic soda, and which is in the form of calcium iron ferrocyanide.

In the discussion on the paper, Mr. R. H. Clayton said that to him the principal point of the paper was the fact that, in the estimation of ferrocyanides in working spent oxide of iron on a large scale, certain losses occur. Certain quantities of ferrocyanides seemed to disappear, and the manufacturing results were not up to 100 per cent. It was evident from the paper that examination of the various methods of analysis showed that certain errors had crept in which had not been noticed before. As regards the Feld method, he had seen this being used in gas-works for estimating the yield of products obtainable from washing gas. He had not previously heard the accuracy of the method discussed in the manner in which Dr. Skirrow had treated it. The method was taken as absolutely reliable, and he was astonished that the little errors pointed out by Dr. Skirrow had crept in. The zinc test was to his mind the most useful one to be employed in ferrocyanide works, unless there was an excess of impurities.

Central Station Gas Engineering in the United States.

We have received from the Trustees of the Gas Educational Fund, through the Secretary (Mr. A. E. Forstall), a copy of the "Catechism of Central Station Gas Engineering in the United States," which has just been published. The matter is a compilation by the Secretary from the questions and answers sent out to the members of the Practical Class, which has been taught by correspondence since 1895—first by the Committee on Education of the American Gaslight Association, and since 1899 by the Trustees of the Gas Educational Fund. The questions and answers have been printed in the "Transactions" of the Association and its successor, the Institute; but many requests were made that they should be arranged according to subjects, and published in one volume. The book under notice has been prepared in compliance with these requests. The Trustees hope that, though primarily intended to give the younger workers in the gas business a fuller knowledge of the principles involved and the apparatus employed, and to aid them in doing better work, the collected questions and answers will be of some service to the seniors, in recalling to them the reasons for methods of operation which have come to be generally accepted. We may take an opportunity of noticing the volume more fully in a subsequent issue.

Mr. Thomas Wood, ex-Provost of Portobello, died last Sunday week at the age of 86. He was for over forty years a prominent man in Portobello, of which place he was Provost from 1867 to 1879. He was elected to represent Portobello upon the Education and District Water Trust when that body was formed forty-one years ago, and remained a regular member of it until his death—having been for many years Convener of the Finance Committee.

The first ordinary meeting for this year of the Society of Engineers is to be held on Monday, the 7th prox., in Caxton Hall, Westminster. The premiums awarded for papers read during 1909 before the Society of Engineers and the Civil and Mechanical Engineers' Society will be presented; and Mr. Diogo A. Symons, M.Inst.C.E., the first President of the new Society, will then deliver his Presidential Address.

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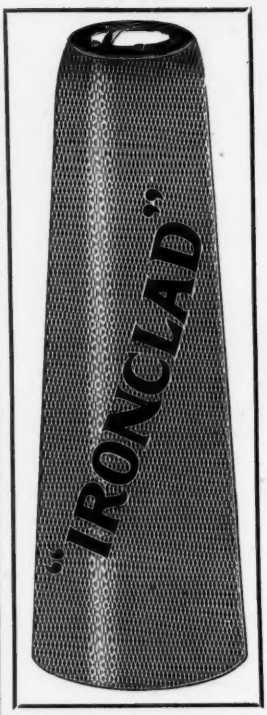

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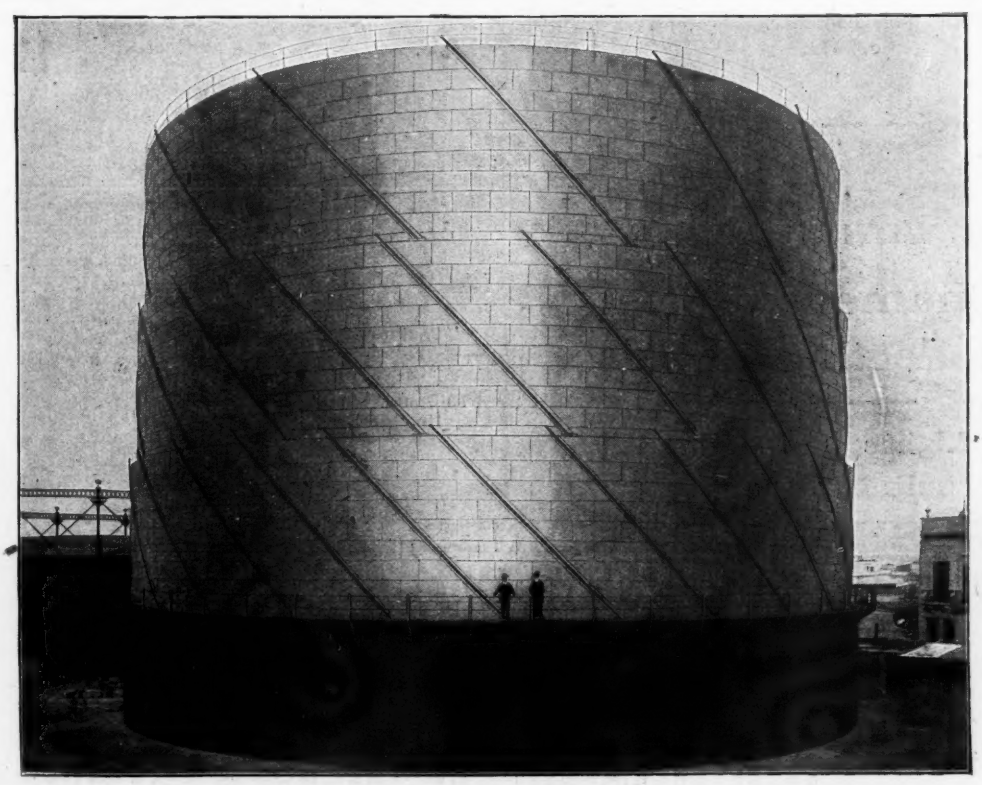

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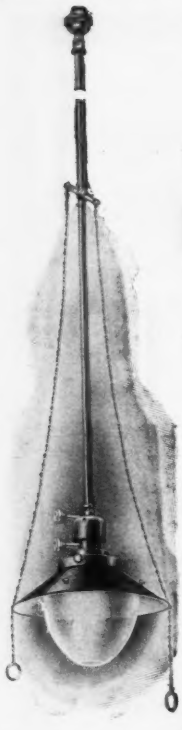

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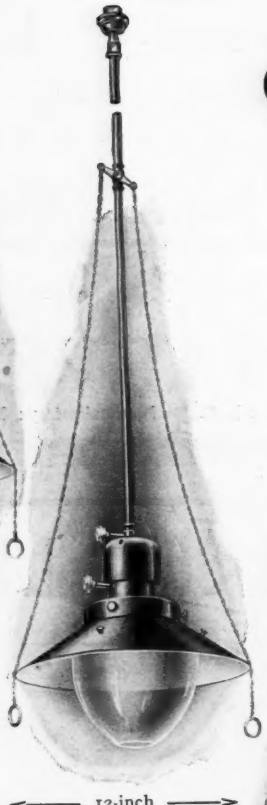

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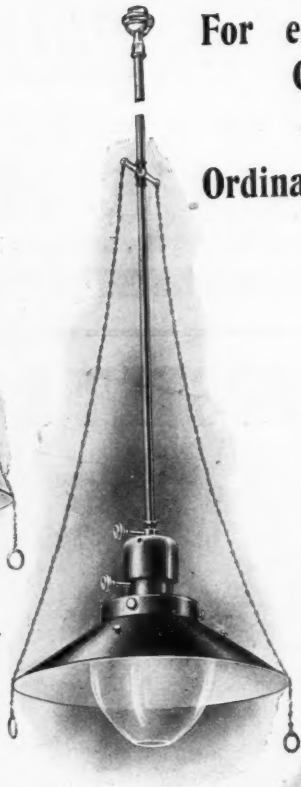

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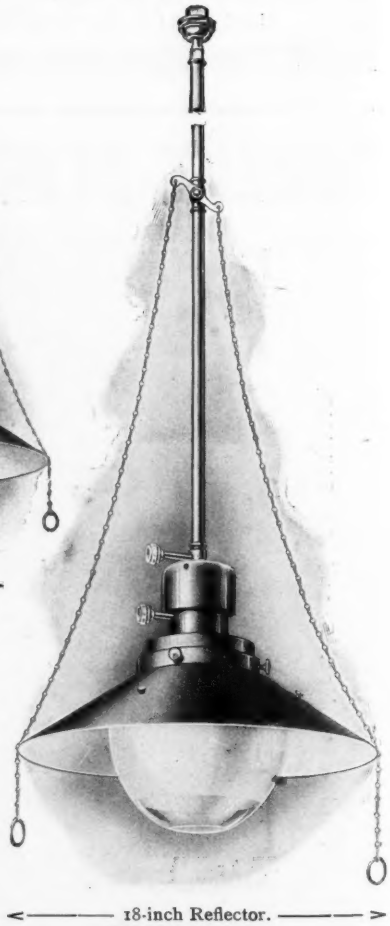

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HIGH-PRESSURE SUBMARINE GAS-MAIN.

Among the "Wrinkles" contributed at the last meeting of the Pacific Coast Gas Association was one on the laying of a high-pressure submarine gas-main. The San Diego (Cal.) Consolidated Gas and Electric Company were solicited very strongly to supply with gas the city of Coronado, on the opposite side of the bay on which San Diego stands. Coronado is quite a small town; and the probable greatest number of consumers in view was only some 300, with the possibility of an additional 500 for three months each summer. Several proposals were brought forward to supply these customers; and finally a submarine high-pressure main from San Diego to Coronado was decided upon. When the capacity of this main and the necessary obstacles to be overcome were borne in mind, two propositions were considered—one being the laying of two 1½-inch heavy lead pipes across the bay in different localities, to avoid possible interruption of service from the anchors of boats. These two pipes were to be brought ashore at the same point, and to be virtually one from there onwards. This scheme was finally abandoned on account of the small capacity, which, while great enough for the present, would not, it was thought, be adequate during the life of the pipe.

A 4-inch extra heavy cast-iron ball-and-socket pipe was used for the work; and the danger from the pipe being broken by anchors was avoided by running to a point on the bay where the ferry crosses from San Diego to Coronado. This particular line between the ferry slips is held by the Harbour Commissioners free from anchorage. The distance from shore to shore is about 4000 feet; and 500 feet of it was what the Company's staff were able to deal with at low tides. The rest was laid from a specially constructed shoot on a lighter moved across the bay by windlasses attached to anchors shifted periodically by a launch.

The pipe used for the line was made in ordinary lengths of 12 feet, with a standard joint on one end, and either a ball or a socket joint on the opposite end; that is to say, two lengths with a standard joint put together left a ball on one end and a socket on the other end of the 24-feet length—thus giving a flexible joint every 24 feet. The standard joints were lightly yarned but were heavily leaded. The ball and socket were cleaned only, and the ball then placed in the socket and leaded and caulked. This was all done on the lighter—in fact, all the material for the work was placed on it before it was moved from the wharf. It required about two weeks to construct and arrange the shoot on the lighter; this being 24 feet wide and 90 feet long. The shoot was built up from one end of the lighter at an angle of about 50°.

The capstans and windlasses were fastened to the four corners of the lighter, and a steam hoist was installed on it for the double purpose of pulling it ahead by the use of headlines and anchors, and also hoisting all the pipe to the work benches and shoot on the incline. An important part of this construction was carried out under water. It consisted of two 100 feet piles placed about 4 inches apart and bolted together and hinged at the upper end to supporting timbers bolted to the lighter. These piles had at the lower end a pair of iron trucks, securely bolted to the lower side of the piles, for the combined purpose of rolling on the bottom of the bay to carry the weight, and also to act as anchors that would not allow these piles and the pipe (when it was being lowered) to be swung sideways by the tide. The line of this pipe passed across the channel of the bay, which was about 40 feet deep at this point, and the tides were very swift. At one time during the laying of the pipe, seven 800-lb. anchors were required on one side of the lighter to hold it against the wind and tide, which were in the same direction.

Another advantage in the piles extending down to the bottom of the bay from the lighter was that, if it shifted even 50 or 100 feet, or twisted from the line of the shore points established, the wheels would get only a slight distance out of the true line which it was desired to follow—acting like a long tail to the lighter. As proof of this, the divers reported that in no place, so far as they could see, were there any bends in the pipe that were more than 18 inches out of a straight line. It required three days to lay the pipe across the bay, and eight days, at $40 per day, for the divers to caulk the pipe until it was absolutely tight. The divers were employed part of the time during the laying of the pipe in following the line as it was laid, and in watching for any breaks or interference with cables in the bay. Each time work ceased for the day, air pressure was applied from the shore end by plugging the end on the lighter, which proved in the first place that there were no broken lengths, and allowed the divers to see any bad leaks.

The shoot built on the lighter was constructed of two 80-feet piles, spaced 4 inches apart and bolted together, and erected on a framework to give them the necessary angle. On each side of this piling were arranged work-tables where four or six 72-feet lengths of pipe could be made up, and be in readiness to roll into the centre shoot at short notice after the lighter had been moved ahead 72 feet. These lengths had the standard joints made up on the floor of the lighter, and then hoisted by the use of a steam hoist to the work-tables on the shoot, where two ball-and-socket joints were made up. After the lighter was moved ahead until only 3 or 4 feet of the pipe was above the water, another length of 72 feet was rolled into the shoot and lowered carefully into the socket. These joints were run and caulked in 10 to 15 minutes, when the lighter was again ready to be moved ahead.

The different angles which the piling, extending from the end of the lighter, took for the various depths of water caused considerable movement of the joints (both the ball-and-socket and standard) during the time of laying—in fact, at some times the angles of the pipe just as it was leaving the lighter were quite sharp. But no trouble was encountered in making these joints absolutely tight later on. At several times two or three joints would stand clear in the air, not touching the shoot for 30 feet. This probably could not have been handled that way except for the extra heavy pipe, which was 25 lbs. per foot, or 300 lbs. per length of 12 feet. The ball-and-socket joint was of the class in which the lead is embedded in the ball end, and the ball end of the pipe carefully machined.

After the pipe was laid to the opposite shore, the pressure was kept on the line all day, allowing the divers to see any leaks, and caulk them either by hand or with an air hammer. To use this hammer, a gasoline air compressor capable of delivering 80 lbs. of air was placed on board the diving outfit's lighter. This, with the necessary hose and a small caulking air hammer, enabled the divers to do much more rapid work, as the air could be used to clear the sand from about the joints, and then the rapid work of the hammer completed the job quickly and solidly. Eight days were required with this diving outfit to make the pipe-line tight. It was tested up to 75 lbs., and dropped only 10 lbs. in twelve hours.

At the Coronado shore end a 30-gallon drip-pot was installed, with arrangements made for blowing the water from it by the pressure of the gas. A similar one was placed in the Company's yard, near the governor-house. In this yard also a steel tank, 90 inches in diameter and 30 feet long, was provided, primarily for storage, but with an arrangement that if any water came through with the gas it would be separated in this tank. From the storage-tank the gas was piped to a double district governor, there reduced from 20 lbs. (the pressure carried on the line) to 4 inches of water pressure, and distributed by means of 8 miles of mains to 250 customers through 4 and 2 inch steel pipe. The cost of the installation was about $5800 (£1160).

ARCHITECTURE AND ILLUMINATION.

In the course of a paper on "The Measurement of Illumination: Daylight and Artificial," recently read by Mr. P. J. Waldram before the Society of Architects, he stated that his chief object was to show that the measurement both of artificial and daylight illumination was so simple a matter, requiring neither special skill nor expensive apparatus, that it ought to be largely undertaken by architects. The photometry of lamps and other light sources demanded delicate and expensive apparatus, specially constructed laboratories, and the exercise of technical and mathematical ability of no mean order. But the photometry of illumination, both daylight and artificial, could be performed with instruments of about the same size, weight, and cost as a good hand camera, and demanded neither technical skill nor mathematical knowledge.

The author described by the aid of a diagram a Preece-Trotter daylight illumination photometer, one of which was on view at the recent exhibition of the Physical Society of London, and gave some examples of inside and restricted outside illumination. He concluded by saying that a rough approximation of a standard well-lit room would be one enjoying an average of 1 candle-foot—in other words, a fair reading light—at half-an-hour after sunrise and at sunset on a clear day, which was given by a proportion of about 1-100oth of the outside illumination. The great present-day need was that architects should take an active and intelligent interest in this subject. They could at least insist that gas and electric sub-contractors should guarantee a given illumination at table height in candle feet. The demand would soon create the supply; and instruments for testing the results were neither expensive nor difficult to use. But, above all, workers were needed who would record data and results. Architects, and architects alone, could do this satisfactorily; and their labours would benefit not only their own profession, but the whole of the working community.

As bearing to some extent upon the subject of the paper noticed above, reference may be made to one on "Modern Gas Lighting in the Store, Office, and Home," submitted to a joint meeting of the American Commercial Gas Association and the New York Section of the Illuminating Engineering Society a few weeks ago by Messrs. Van Rensselaer Lansingh and Edward B. Rowe. It was an illustrated description of the central appliance house maintained by the Consolidated Gas Company of New York City. Between the reception-room and library, on either side of the passage, are located booths or small rooms for demonstrating the great effect of the colour of walls on the illumination of any given plane by any given unit of light. Each booth is lighted by one inverted mantle burner with clear distributing reflector and clear cylinder in the centre of the ceiling. The control is pneumatic, from a push-button on the wall. The curtains for the booths are all faced on the inside with material of the same shade as the wall paper, and the colours adopted for the latter are as follows: (1) Salmon, (2) red, (3) cream, (4) green, and (5) blue. The wall papers are of nearly the same texture; and any difference in the

illumination obtained can be considered as due to absorption by colour alone.

Readings were taken in all the five booths, to obtain some comparative figures for this absorption. In each booth the mantle was adjusted to give as nearly as possible the same candle power value directly below the centre of the lamp, as measured by the illuminometer used as a photometer. Since the equipment was the same in all the booths, the distribution and total flux of light would be approximately the same when the candle powers at any one angle were equal. Then with the illuminometer disc 2 ft. 6 in. from the floor, foot-candle values were obtained at the point directly beneath the lamp as follows:—

Colour.	Foot-Candles.	Per Cent. of No. 1.
Salmon	3·34	100
Red	1·87	56
Cream	2·93	88
Green	1·67	50
Blue	2·36	71

The authors say that not only does the intensity vary greatly with the colour of the paper, but the character of the reflected light is quite different. This was very noticeable in making the illuminometer settings, where the colour of the two fields in the prism varied greatly in the different booths. Very nearly a perfect colour match was obtained in the test in booth No. 1, which showed the highest foot-candle reading. In a measure, these readings, as are all illuminometer readings, in fact, are only indicative, since so much depends on the personal equation in setting for a colour match, rather than for intensity. The authors consider that the question of light absorption by colour, and its effect on efficiency, as well as its physiological and psychological importance, justify the illustration and explanation of these colour effects to the general public. The effect of different illuminants on the same colours has been repeatedly demonstrated; but this is the first instance they know of where prominence has been given to the effect of one illuminant on different colours.

HOIST FOR FILLING PURIFIER-BOXES.

Some time ago, Mr. F. C. Millard, of Los Angeles (Cal.), devised a successful scheme for converting a cement hoist into an oxide hoist—galvanized iron buckets being employed. A steel tower was built, with adjustable clutches at the top so as to deposit the material at any point desired. The bucket was pulled up the tower by means of a windlass driven by a motor, and when it reached the desired point the clutches tripped it up, and it emptied its contents into a galvanized iron shoot placed there for the purpose. The shoot was about 18 inches deep, and open on top. It ran directly into the centre of the purifier-house, and its course could be diverted into any box desired by means of another shoot attached to the first one by the help of a swing joint. With this system it only took about an hour to fill a box, compared with five hours by the old system. The life of the oxide was found to be much longer, as it did not break up into fine powder as is the case when using the ordinary conveyor.

While this system was a vast improvement on the old conveyor, Mr. Millard found that he could improve upon it. He has communicated the result in a "Wrinkle" to the Pacific Coast Gas Association. When the plant increased to such an extent that he was obliged to double his purifier capacity, and he found it imperative to instal another apparatus for conveying oxide to the boxes, he had plans and specifications prepared, and gave an order for another hoist similar to the one just described, but with the shoot made of 15-inch galvanized iron pipe, and having three different stations, as it were, for the discharge of the oxide. These stations or platforms are located about one-third, half, and nine-tenths of the way up the tower. From the nearest platform there is a pipe running to the nearest boxes to the tower; at the second platform, the pipe runs to the middle boxes; while at the top platform, it runs to the boxes farthest from the tower. By this improvement Mr. Millard says it is possible to have a pipe run directly from the discharge platform to each and every box, instead of having one shoot for the whole set of boxes. He also finds that, by having the 15-inch pipe instead of the shoot, there is no loss of oxide from the wind blowing it out.

Gaslight and Coke Company's Dividend.

We are informed by the Secretary of the Gaslight and Coke Company, Mr. H. Rayner, that the accounts for the past half year show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 13s. 4d. per cent. per annum, carrying forward to the next account £456,993 4s. 8d. This compares with a dividend of £4 10s. 8d. per cent. per annum, and a carry-forward of £423,323 this time last year. For the June half year, the dividend was at the rate now recommended; and the amount carried forward was £409,893.

Annual Meeting of the Institution of Gas Engineers.—We are asked by the Secretary, Mr. Walter T. Dunn, to announce that it has been decided to hold the annual meeting of the Institution this year in London; to commence on Tuesday, the 14th of June.

AMERICAN GAS INSTITUTE AND ELECTROLYSIS.

Memorandum by Professor Ganz.

In the summary of the proceedings at the last annual meeting of the American Gas Institute, it was mentioned that the Committee on Electrolysis, of which Mr. A. G. Glasgow is Chairman, submitted a memorandum on "The Protection of Underground Pipes from Electrolysis." It had been prepared at their request by their Consulting Electrical Engineer—Mr. Albert F. Ganz, Professor of Electrical Engineering in the Stevens Institute of Technology—and was intended to set forth, as far as practicable, the views and work of the Committee. In their brief report prefacing the memorandum, the Committee stated that the chief obstacle to effective progress which continued to face them was the very reasonable objection on the part of the various interests concerned to making public the results of important current investigations, owing, in the first place, to the fact that present conclusions are of necessity of a more or less tentative nature, and, secondly, to the fact that the present phases of these specific investigations are invariably of a confidential and generally of a delicate local character. These considerations had, they said, largely hampered Professor Ganz in the preparation of his memorandum, and had made it impossible for the Committee to secure other communications which they had anticipated would be at their disposal. They further expressed the opinion that no useful purpose would be served by the continuance of a Standing Committee on Electrolysis. They considered it preferable, at any rate, for the present, that the General Technical Committee should, as opportunity offered, obtain communications from experts specially qualified to instruct or guide the members in some particular line of this work. They therefore jointly and severally tendered their resignations, together with their best thanks for the confidence reposed in them.

The following is Professor Ganz's memorandum.

PROTECTION OF UNDERGROUND PIPES FROM ELECTROLYSIS.

At the annual meeting of the Institute two years ago, I presented a brief paper in which the general methods of making tests for stray electric currents on underground piping systems were discussed.* Since then I have had considerable opportunity of using the methods described. While it has been found necessary to extend these methods, and also to use a number of special methods to meet particular cases, particularly for the purpose of identifying sources of stray current, the general plan outlined in my previous paper is sufficiently complete for ordinary requirements. I will, therefore, not discuss methods of testing, but consider measures for the protection of underground pipe-lines from electrolytic corrosion, where they are found to be endangered by stray railway currents. The natural solution is, of course, to remove the cause of the danger—that is, to get the railway companies to take care of their own currents. This is completely accomplished by the use of an insulated return circuit. Even without this, I believe that in almost every case where serious stray railway currents are found flowing on underground structures, it is possible to reduce such currents to small and oftentimes to negligible amounts by proper track-bonding, and by the installation of properly proportioned return feeders, with the addition in some cases of negative boosters.

The possibilities which can be accomplished in this direction have only recently been appreciated in America by railroad engineers. An excellent investigation of this subject is presented by Mr. George I. Rhodes, in a paper entitled "Some Theoretical Notes on the Reduction of Earth Currents from Electric Railway Systems by Means of Negative Feeders," published in the "Transactions" of the American Institute of Electrical Engineers for 1907. This investigation clearly brings out the great reduction of stray currents which can be accomplished by insulating the negative bus-bar at the power-station, and running out properly proportioned insulated return feeders to various points in the track network. This is, in fact, the plan which has already been very successfully carried out in Europe, and which was described in the report of the Committee on Electrolysis presented to the Institute in 1906. I am informed on excellent authority that in two American cities the installation of properly proportioned radiating return feeders, as referred to above, has reduced the stray currents on the piping systems to less than one-tenth of their former value. In some cases where a road owns its own private right-of-way, it is perfectly practicable to substantially insulate the rail return circuit, and eliminate serious stray currents.

If the underground piping system is a continuous electrical conductor of low resistance, and is affected only by currents from known sources, it may be protected by metallically connecting it to the negative return circuit of each source. Such a bonding method, however, greatly increases the current flow on the system and produces other dangers, as, for instance, at a high resistance point, which may develop in a joint. Here the current may shunt around such a high resistance point and produce corrosion. The greatest objection, however, lies in the danger that such a bonded system constitutes to all other underground metal systems. If we connect one piping system to the negative bus-bar, we render it highly negative to all other underground metallic structures, and induce current to flow to this piping system, thereby increasing

* See "JOURNAL," Vol. CI., p. 293.

the electrolytic dangers to other systems, and producing also other dangers, such as a fire hazard from sparks or arcs. Such a bonded piping system becomes, in fact, a part of the trolley return circuit, and the owner becomes a party to any damage that may result in the other underground systems. I have myself found various cases where actual danger and damage were caused to one underground system by the bonding of a second system. I know of one case where a large piping system was bonded to the negative return circuit of the railway by heavy copper cables in order to protect it from electrolysis. Serious trouble arose, however, from arcs produced by the large currents carried on the pipes, and explosions and fires resulted—in one case also severely burning a mechanic who was making repairs to the pipes. After two years of trial, all bonds were removed, as the dangers produced by them were considered more serious than the possible protection from electrolysis afforded. I firmly believe that only such methods should be used as will substantially prevent stray currents flowing to and from the underground structures.

In regard to means which can be applied to piping systems to rid them from stray railway currents, there are two possibilities to be considered which have been tried—viz., insulating pipe-joints and insulating pipe-coverings. I have had some experience with, and have made some tests in regard to, each one of these methods. In order, however, to collect the experience from as many sources as possible, I addressed a circular-letter and question-blank several months ago to each member of the Institute, with the authorization of the Committee on Electrolysis, asking for his experience, especially with reference to the above means for the protection of pipe-lines. In all, 1308 question-blanks were sent out and 138 replies were received. Of these, 74 do not give any useful information at all, while the remaining 64 answer some or all of the questions, or give other definite information. I have made a careful study of the replies as received; and where the answers given did not enable me to get all the information desired, I have endeavoured to get this by further correspondence. A number of the members were good enough to furnish me with copies of electrolysis surveys made upon their systems; and I have also studied these in connection with the answers furnished. In this way, I have collected experiences with about 60 piping systems located in 32 different States scattered all over the United States. I have prepared extracts giving the important facts of such answers as describe characteristic conditions, and these are tabulated under three headings: "Experience with Cement Joints," "Experience with Insulating Joints," and "Experience with Insulating Coverings."*

Discussion of Experiences with Cement Joints.

Thirty-nine replies report experiences with cement-jointed mains in the vicinity of electric trolley roads. Thirteen of these replies state that no trouble whatever from electrolysis has been found. In most of these cases, however, no actual tests have been made; the statement being merely based on general experience. Seven replies report some electrolytic corrosion of the cast-iron mains; one of these reports corrosion at joints and the complete destruction of the structure of the cast iron. One other reply reports signs of pittings near the joints at a number of points. In twenty replies the electrolytic destruction of service-pipes from cement-jointed mains is reported; and in some of these cases this trouble is said to be very severe.

I have examined two systems in which services from cement-jointed mains have been quite destroyed. It was found that the destruction had been caused by electrolysis from stray railway currents, and that these currents had reached the gas service-pipes from the water-mains through house-service connections—that is, current was found entering by the water service-pipe from the water-main, reaching the gas service-pipe through the house piping, leaving it through ground to return to the railway tracks, and producing corresponding electrolytic destruction of the gas-pipe. Tests also showed that the water-main, which was laid with lead joints, in these instances, was carrying large stray railway current; while no measurable current was found flowing on the cement-jointed gas-mains.

I want to report one case of damage relating to a lead-jointed gas-main, where current was also found entering a building from the water-main through a water service-pipe, and leaving the building through the gas service-pipe. The existence of this current on the gas-pipe was discovered when a meter was to be replaced, by the production of a severe arc when the pipe was disconnected. An examination showed that current entered by the water-pipe and reached the gas-pipe through contacts with a metal ceiling. This current was very large, reaching maximum values of 16 amperes. This condition was found in a district where the gas-piping is highly negative to the railway return conductors; the current from the gas service-pipe flowing to the gas-main, and passing along it to leave it at some other point. Electrical tests indicated that the water-piping system was in metallic contact with the railway return conductors. This is an example of a distinct fire hazard produced by stray railway current entering and leaving a building through the service-pipes; and I have found similar cases elsewhere. This same dangerous condition is, in fact, likely to occur wherever there enter a building services from two piping systems, one of which is bonded to the return circuit of the electric railway.

In order to obtain the approximate electrical resistance of cement joints, I have measured the resistance of a large number of joints on different sizes of mains in actual use. The resistance values found vary from a fraction of an ohm to several hundred ohms; the majority of joints showing high resistance values.

Two cement joints on 8-inch cast-iron pipes were also subjected to tests in the laboratory of the Stevens Institute. These joints were tested for resistance after having been made-up for several months with currents varying from 0·02 ampere to 5 amperes. One of these joints showed a practically constant resistance of about 40 ohms. The second joint showed a variable resistance for different current strengths. With 0·02 ampere it was 28 ohms; with 1 ampere it was 4 ohms; and with 5 amperes it was only 0·7 ohm. This phenomenon of variable resistance with different currents is characteristic of imperfect contacts. It is therefore likely that in the cement joint showing the variable resistance the end of the spigot is in mechanical contact with the interior of the bell, but forming an imperfect electrical contact; while in the first joint, showing a constant resistance, the end of the spigot and the interior of the bell are out of contact altogether. Six additional cement joints on 8-inch cast-iron pipes were also subjected to laboratory tests after having been made-up for about a month. Three of these joints showed low resistances varying from 0·01 to 0·05 ohm; while the remaining three joints showed resistances varying from 5 to 10 ohms. Each of these six joints showed some variation in resistance for different current strengths, but the variations were not large. It appears that in the three joints showing low resistance the pipes must be in metallic contact; while in the three showing high resistance there is no metallic contact. It is probable the resistance of these cement joints will increase with age.

All the cement joints tested except those which show such low resistance values as would indicate metallic contact, showed a polarization voltage varying from 1·5 volts immediately after the current was removed to about 0·1 volt after 24 hours. This means that a voltmeter connected across one of these joints gives an indication after the current has been interrupted. While this polarization voltage cannot produce any substantial current flow, its existence is nevertheless significant, and may give rise to misleading conclusions from tests upon cement-jointed mains. As an example of this, I would cite an experience which I had about a year ago. On a cement-jointed main, no readable deflection could be obtained on a sensitive millivoltmeter in 11 feet of continuous pipe. Across one cement joint a potential difference of 0·22 volt was indicated, however, and across the adjacent cement joint a potential difference of 0·13 volt; while across both joints the potential difference was nearly 0·4 volt. The measurement of the potential difference over 750 feet of this main, including about 60 cement joints, gave a value of 0·5 volt; but an ammeter connected across these two points by copper wires did not indicate any measurable current. It is therefore clear that this main, though showing substantial potential differences across individual joints, was not carrying any measurable electric current.

So far as being effective in breaking up the electrical continuity of a pipe-line laid with all cement joints, it does not matter whether the joints have a resistance of a few ohms or of thousands of ohms. Considering that the resistance of cast-iron pipe is only a few hundred thousandths of an ohm per foot of length, it will be seen that, compared with the pipe itself, the resistance of a cement joint is generally so high that it may be classed with insulating joints. It follows, therefore, that a pipe-line laid with all cement joints has such a high electrical resistance that, with the potential differences ordinarily found in the ground, no measurable current can flow along such a line. Numerous tests made by myself confirm this. An interesting and valuable test is also reported in one of the replies. A cement-jointed cast-iron main paralleling a trolley track was metallically connected to the track at its two ends with an ammeter inserted in one of the connecting wires. No measurable current was indicated on the ammeter. In this same system the cement-jointed mains are connected to the return circuit of the railway at the sub-station. An ammeter was connected in this bond wire, but no current flow could be detected. Similar results were obtained in a series of tests made upon a cement-jointed water-main in Los Angeles (Cal.), and reported by Mr. E. F. Scattergood in a paper published in the Sibley "Journal of Mechanical Engineering" for March, 1905.

Bond connections from cement-jointed mains to the return circuit of electric railways, as reported in a number of the replies, can therefore protect only that single length of pipe, and the services connected to it, to which the bond wire is attached, but cannot possibly serve to protect the piping system.

Discussion of Experiences with Insulating Joints.

Nineteen replies report experiences with special forms of insulating joints. Most of the pipe-lines where the use of insulating joints is reported are individual high-pressure lines to which no service-pipes are connected. In four of these pipe-lines every coupling is made an insulating joint, and it is reported that they do not carry stray currents, and that there is no trouble from electrolysis. In twelve of these pipes, a comparatively small number of insulating joints are used, variously spaced, depending upon local conditions; and it is also reported that there is no trouble from electrolysis. Most of these lines have, however, been in service for an insufficient time to warrant the conclusion that no electrolytic action is going on.

In two high-pressure lines where insulating joints were spaced 500 feet apart, serious electrolytic damage resulted; and it is

* These are given in an appendix to the memorandum.—Ed. J.G.L.

reported that these pipe-lines have since been connected to the negative return of the railway, and the insulating joints bonded over by copper cables, thus eliminating the insulating feature of the couplings. A wrought-iron pipe-line paralleling a poorly constructed trolley road for 34 miles, with three power-houses located along the line, and with Dresser expansion sleeves located every half mile, is reported to have suffered from electrolysis in the neighbourhood of the power-houses. In one reply it is reported that an entire city gas-supply system is laid with wrought-iron pipe with nearly all the couplings insulated joints, and that after six years of service no trouble from electrolysis has developed. I have also had occasion to test one high-pressure wrought-iron main laid with all Dresser joints several miles long, and paralleling and running close under trolley tracks for a considerable distance. This main did not show any measurable flow of current, and a temporary copper wire connection with an ammeter in series between the pipe and the rails at a number of points did not produce any flow. This pipe-line has been in service for more than five years, and so far has given no trouble from electrolysis.

Experiences with Insulating Pipe Coverings.

Sixteen replies report experiences with insulating pipe coverings, and all but two of them refer to service-pipes. One of the two mains provided with an insulating covering is a 2-inch high-pressure line a mile long, and connected at one end to a gas-works and at the other end to holders. This pipe was boxed and filled with pitch; but electrolytic trouble developed at several points, at some of which the covering was found to be defective. By breaking up the line into insulated sections by insulating joints in addition to the covering, the trouble is stated to have been overcome. The second main is also a high-pressure line, of 3-inch wrought-iron pipe. The attempt to protect this by boxing it and filling with concrete, failed. A portion of this line which was boxed and filled with 2 inches of pitch also developed electrolytic trouble at a few points; but it is stated that at these points the covering was found mechanically damaged. Examination of the pipe under a good coating of pitch showed the pipe to be bright and without signs of corrosion. Five of the service-pipes protected by coverings were painted with some form of compound, usually containing tar. These coatings are found to prolong the life of the services, but do not generally prevent electrolysis. Five services were boxed and filled with pitch, which proved effective in four cases but failed in one case. Four services are reported boxed and covered with cement or concrete; and this appears to have prolonged the life, but has not prevented electrolysis.

In regard to cement or concrete as a protection from electrolysis, I know of one case where an 8-inch pipe was boxed, leaving from 4 to 5 inches between pipe and box, the space being filled with concrete. This main was in a location where currents were leaving the main, and where previously there had been considerable electrolytic action. It was found that the corrosion went on at least as rapidly with the main embedded in concrete as before; and the main was destroyed in a comparatively short time. When the box was broken open, the iron pipe was found to be very badly corroded and pitted, and the rust had penetrated more than an inch into the concrete. Investigations made by Knudson and by Langsdorf also show that iron and steel embedded in concrete will be corroded by electric currents passing from the iron or steel through the concrete.

I have had occasion to examine a steel main which had been dipped in a tar pitch compound before being laid, and which had been in service for about five years. The coating in most places was found to be apparently intact and firmly attached to the steel, and varying from about 1-32nd to 1-8th of an inch in thickness. At other places the coating appeared cracked and was brittle, or was entirely removed for considerable areas. In a locality where the main was lying in a marsh, and was subject to electrolysis from stray currents, deep pittings were found in the steel under apparently good, heavy coating, which in some cases had to be scraped away with considerable force. Electrolysis appears in this case to have gone on under an apparently perfect insulating coating.

In reply to my question-blank, Mr. Robert B. Harper, the Chief Chemist of the People's Gaslight and Coke Company of Chicago, kindly sent me a copy of a paper on "The Comparative Values of Various Coatings and Coverings for the Prevention of Soil and Electrolytic Corrosion of Iron Pipe." This paper was read by him before the Illinois Gas Association on March 18, 1909, and contains the results of an exhaustive investigation of a large number of commercial pipe coatings and coverings. The results given are of great value in the study of the problem of pipe protection.* The conclusions drawn by Mr. Harper are so to the point, and agree so well with my own experience, that I wil quote them in full:

1.—That paints, as a rule, do not prevent electrolysis, but some no doubt have a beneficial effect in curtailing soil corrosion.
2.—That the appearance to the naked eye of a paint film is no indication of its permeability to water.
3.—That corrosion of metal may take place beneath a paint film without apparently affecting its appearance.
4.—That the metallic body, before being covered, must be smooth and free from rust, moisture, loose scale, and foreign matter in order that it be preserved.
5.—That, in general, dips applied hot are better than paints, and probably furnish the key to the solution of the prevention of corrosion.
6.—That concrete of itself is not an efficient protection against electrolysis.
7.—That ingredients such as rubber, tallow, lime, &c., usually have a deleterious effect upon the efficiencies of coal-tar pitch.

* Mr. Harper's remarks on the value of coal tar as a protective covering for pipes were given in the "Journal" for July 20 last (p. 185).—Ed. J.G.L.

Summary and Conclusions.

The statement that a given piping system is not suffering from electrolysis cannot always be taken as evidence that the system is actually free from stray currents and is immune from electrolysis, and especially not when reference is made to cast-iron mains carrying gas at ordinary pressures. The effect of electrolytic corrosion of cast iron is to oxidize the iron, leaving the iron oxide and the graphitic carbon in place, whereby the form of the pipe is kept intact. I have seen cast-iron pipe which was apparently in good condition, and carrying gas without leaking, which, upon being tested with a hammer, was found to be pitted entirely through the iron in more than one place. I have seen such cases where the blow of a hammer caused a plug, as large as a silver dollar, of these graphitic remains from electrolysis to drop out, exposing a hole through the pipe. Some of the replies which report that there is no trouble from electrolysis, and where no proper examination has been made, do not, therefore, afford conclusive evidence of immunity from electrolysis.

Cement joints, as ordinarily made, do not generally produce metallic electrical connection between the two pipes; and such joints may practically be classed with insulating joints. A pipe-line laid with all cement joints or with insulating joints is therefore a discontinuous electrical conductor, and is not capable of carrying stray electric currents. Such a pipe-line cannot, therefore, pick up current in an extensive negative area to discharge it in a restricted positive area, which is generally the cause of the most serious electrolytic danger. For this reason, a piping system with all cement or insulating joints is, on the whole, much less likely to be affected by electrolysis than a piping system with all lead joints or with screw couplings. Experience has shown, however, that a cement-jointed piping system is by no means immune from electrolysis; and we have abundant reports which show that cement-jointed mains, and especially service-pipes from such mains, can suffer severely from electrolysis. In these cases the stray currents reach the mains and service-pipes from other pipes or by other paths.

Where the current which reaches a service-pipe connected to a cement-jointed main can be definitely traced as coming from house services, it is possible to stop this flow of current by introducing an insulating coupling in the service-pipe inside the building or in the riser connecting to this service-pipe. It is also conceivable that a pipe may lie in ground in the path of earth currents of sufficient density to produce electrolytic action upon the pipes. Such a high density of earth currents may exist in the immediate vicinity of electric railway power stations having a poorly constructed return circuit. A reasonably good construction of the return circuit of the railroad should, however, prevent the existence of any such dangerous current density in the ground, as this current would be a source of great danger to all underground metal lying in its path, including steel building foundations.

The question of whether a pipe-line can be protected from electrolysis by installing a limited number of scattered cement or insulating joints, depends entirely upon local conditions. There are undoubtedly cases where the installation of even a few insulating joints at proper places will greatly reduce, if not eliminate, electrolytic danger. Experience has shown, however, that a few individual insulating joints may do more harm than good; and they can only be applied in special cases, and then only at points where electrical tests have indicated that they will do good.

As to the cause of the high resistance of cement joints, this is probably due to the fact that though in laying cast-iron pipe every attempt is made to push the spigot end home into the bell, as a matter of fact in most cases the two pipes are not in metallic contact. Even where there is contact, it is probably over a comparatively small area, if not at a point. As the end of the spigot is always heavily coated with scale, such metallic contact generally forms a poor electrical contact of comparatively high electrical resistance. It is a simple matter to positively prevent metallic contact by inserting a ring of some cheap insulating material, such as fibre or cardboard, between the end of the spigot and the interior of the bell; and this has been done in some cases. The resistance of cement joints is then the electrical resistance of the cement intervening between the spigot and the bell; and while cement is not an insulator (but, on the contrary, is probably as good a conductor as ordinary ground), compared with iron the resistance is so high that the cement joints practically interrupt the electrical continuity of the pipe-line.

In the case of lead joints, I have had occasion to measure the resistance of several hundred joints in use on various sizes of pipes. These joints generally have a comparatively low resistance—being equivalent, as a rule, to the resistance of 10 or 20 feet of continuous pipe. Occasionally, however, I have found lead joints which have resistances equal almost to 1 ohm, and equivalent to upwards of 10,000 feet of continuous pipe. I have

made special tests, in the laboratory of the Stevens Institute, upon two cast-lead joints and upon two lead-wool joints made on 8-inch cast-iron pipes. These joints were made in every respect as is done in practice, and without taking any special precautions; and the resistance tests were carried out a couple of months after the joints had been caulked. The resistances found were as follows: 0·0002 ohm for the first cast-lead joint, 0·00006 ohm for the second, and 0·00003 ohm for each of the two lead-wool joints. The resistance of the latter joints appears to be about half that of the lowest resistance cast-lead joint. The resistance of a lead joint is almost entirely that of the surface contact between the lead and the iron. The lower resistance of the lead-wool joint is, therefore, probably due to the fact that the lead of the joint makes contact with the iron over a greater area than in the case of the cast-lead joint. Since the resistance of a lead joint is that due to the surface contact, it is clear that such joints are likely to increase in resistance with age; and this appears to be borne out in practice. I remember testing one lead joint in a very old pipe which gave a value of about 0·4 ohm. By standing on one of the pipes, the resistance was reduced to one-tenth of its former value, due probably to the fact that under the strain better surface contact was made between the lead and the iron.

Where a cast-iron lead-jointed main has been in the ground for a number of years, it is probable that many of the joints have reached such high resistance values as to effectively break up the electrical continuity of the pipe. I have also found that very old pipe, especially early pipe that was imported from Scotland, is coated with a surface scale or oxide which has such a high surface resistance as to be practically an insulating covering. I have found cases where it was necessary to apply chisel and hammer, and cut through a thick and very hard coating, before electrical contact to the iron could be made. Where such old pipes were in the ground before electric traction was started, they are very much less subject to trouble from electrolysis than new pipe, affected immediately by stray current; the effect of the electrolysis being to produce a condition around the pipe which aids corrosion, and prevents the formation of a self-protecting insulalating covering.

In regard to the use of insulating pipe coverings, experience shows that embedding a pipe in cement or concrete, even if this is several inches in thickness, does not protect the pipe from electrolysis, and in some cases it has even been found that the pipe in concrete is destroyed at least as rapidly as when it is buried in ground.

As to the use of paints or dips for protecting pipes, the first difficulty is the mechanical one of applying the paint so as to form an absolutely perfect coating, and then to prevent mechanical damage to the coating. Where imperfections exist or develop, aggravated trouble always ensues. Experience further seems to show that even where paints or dips are apparently intact and perfect, electrolytic action is not prevented—in fact, very serious electrolytic pittings have been found under apparently quite good coatings.

The only kind of insulating covering which appears to afford certain protection is a layer of at least one or two inches of a material like coal-tar pitch or asphaltum, of such a grade that it is not brittle and so will not crack, but yet is hard enough to remain in place. The best way to apply such a layer is to surround the pipe with a wooden box, support the pipe upon creosoted blocks of wood or upon blocks of glass, and then fill the space between the box and the pipe with the molten material. As a further protection, an insulated coupling should be introduced at each end of the section, covered so that, even if the covering should become defective at any point or points, no current can reach these points to corrode them by electrolysis. A pipe treated in this way, with the work done so as to be mechanically perfect, would undoubtedly be protected from electrolysis. However, the cost of carrying out such an installation is absolutely prohibitive, except in a few cases, such as in the case of service-pipes in very bad localities, or of some very important individual pipe-lines of small size. It is not sufficient to apply the covering only in the positive district; nor, on the other hand, is it always necessary to cover the entire length of line. The portions which must be insulated can only be determined by properly conducted electrical tests.

Regarding the use and value of an electrolysis survey, it must be remembered that the object of the survey is to indicate the existence or non-existence of stray electric currents upon a piping system, and to determine where such currents flow on to the pipes and from the pipes. I have had occasion to examine a large number of electrolysis surveys, some of which were kindly lent to me by members in reply to my question-blank. Most of these surveys consist, however, exclusively of voltmeter readings. Such readings by themselves do not afford a measure of electrolytic danger; they merely indicate where the greatest danger is likely to exist. Measurements of current flow on pipes are essential in an electrolysis survey, because all current which flows on a pipe must leave it; and the amount of damage produced is proportional to the total current which leaves the pipe. I have seen some reports, on the other hand, where it is stated that the current on a given pipe is zero, but where the instruments and methods employed were not sufficiently sensitive to detect currents as large as 2 or 3 amperes, and where, therefore, the conclusion of zero current is not warranted.

From a complete and properly analyzed electrolysis survey, a great deal of good can generally be accomplished. It will not always be possible to remove all stray currents from the pipes; but measures will be indicated by which the conditions can be much improved, and points of greatest danger will be located. If then trouble does occur at a later time at these points, the electrolysis survey may be most valuable in affording proof of the destruction of the property from railway currents, and may be the means of compelling the railroad company not only to pay for the damage, but also to make improvements in its return system so as to avoid the recurrence of such damage. I know of a number of electric railroad companies who are regularly paying for damage caused by electrolysis to piping systems. The knowledge that a pipe-owning company is making electrolysis tests and is keeping watch on the situation, also has a strong moral effect on the electric railroads.

In conclusion, I wish to say that I have no doubt some of the members will be disappointed in my paper because I have not been able to present a simple cure-all for electrolysis. I am afraid that the only possible cure-all is an insulated railway return system. I am convinced, however, that in nearly every case where serious stray railway currents flow on piping systems a very great reduction of these currents can be accomplished by improvements in the return circuit of the railways, and in many cases these stray currents can be reduced to a small fraction of their former amount. And this should in every case be the first step. After this has been done, there are many cases where insulating methods judiciously applied to the piping system will further greatly reduce the stray currents which still remain.

Appended to the memorandum are a large number of extracts from the replies received by the author to his questions.

GAS DISTRIBUTION IN SAN FRANCISCO.

By W. R. Morgan.

[Extracts from a Paper read before the Pacific Coast Gas Association.]

The distributing system of San Francisco is the result of about sixty years' growth, and represents the efforts of eight Companies which have flourished for longer or shorter periods since the year 1852, when the San Francisco Gas Company was incorporated. Subsequently, the following Companies came into existence: Citizens (1862), City (1870), Metropolitan (1871), Central (1872), Pacific Gas Improvement (1883), Equitable (1898), and Independent Gas and Power (1901). All these Companies have been absorbed by the original San Francisco Gas Company, now known as the San Francisco Gas and Electric Company, who have inherited from them some 300 miles of mains. Each system has contributed its advantages and defects—its services, valves, drips, and leaks. A complete plan of the mains would be practically a map of the city. Nearly every house is reached by the services, and every gas street-lamp is supplied from the mains.

The entire low-pressure system is of the arterial type—*i.e.*, open from end to end to the free passage of gas. Considering its haphazard growth and lack of comprehensive design, it is better adapted to its purpose than might be supposed. The various independent lines have been so tied together that individual deficiencies are supplied by the strength and completeness of the whole. In localities where consumption is greatest, two mains are used—one in either side of the street. This double arrangement affords advantages that cannot be secured when only a single main is available—for example, shorter services, greater storage capacity, lighter drag at peak hours, and insurance of uninterrupted service, as either main will suffice temporarily should a stoppage or a serious break occur in the other.

In outlying districts there is a scarcity of large mains—2-inch and 4-inch being commonly used. The former are being replaced gradually with larger sizes, and no more 2-inch pipe is being laid, except in ungraded and unpaved streets, where the number of services to be installed will not exceed four or five. The problem involved is not the theoretical capacity of the main according to Pole's formula, but the great uncertainty regarding its condition after a few years' use. Unless there is a fall of at least 5 per cent., a trap is likely to occur; moreover, 2-inch pipe is easily choked by naphthalene, and a long run is not readily cleared. Invariably, such mains have been prolific sources of complaints, and are maintained only at an expense unduly great compared with larger ones.

The city of San Francisco is built upon the northerly end of a narrow peninsula, lying between the Pacific Ocean and the bay of San Francisco. On the north is the well-known "Golden Gate"—a narrow, picturesque channel, connecting the ocean and the bay. Regarded as a field for gas distribution, the city is approximately square, with boundary lines conforming closely to the cardinal points of the compass. The area to be supplied is 36 square miles. Elevations range as high as 450 feet above sea level; and the nature of the soil varies from alluvial deposits and sand to a fairly hard granite. Dividing the area by centre lines into four equal squares, the north-easterly section is occupied by the business district and western addition, the north-westerly by the Richmond district, the south-westerly by the Sunset and Parkside districts, and the south-easterly by the Mission and Potrero districts.

Gas is supplied from the Potrero station, located on the bay

shore at about the middle of the easterly boundary. From this point the two principal trunk lines (24 and 30 inches) extend westerly and northerly a distance of 4½ miles to the North Beach station, on the northerly boundary line of the city. No gas has been made at this station since April, 1906; but a 2 million cubic feet storage holder is still utilized; being filled during the day and gas delivered at night by a blower and compressor.

The north-easterly quarter section of the city includes the original mining town of early San Francisco, where, in 1852, Peter Donohue started his infant gas-works. This section is amply provided with large mains well connected, and having a good circulation. The sizes run from 10-inch to 20-inch in the trunk lines, and in turn supplying a grid-iron of smaller mains running through every street and alley, and connected at every crossing. Richmond, in the north-westerly corner, has presented a serious problem. In 1906, this was a sparsely-settled district, provided only with 2-inch and 4-inch mains. It is three miles from the North Beach station, and six miles from Potrero. Dead-ends were the rule, and services were small—mostly 1-inch. Shortly after the fire, the population was increased fully four-fold by an influx of people who had been burnt out. Every vacant house was filled, and many new houses and stores were quickly built. The combination of small mains, long distance, and sudden increase of consumption, developed a deplorable "no gas" condition. A 4-inch auxiliary high-pressure line, from the North Beach station, furnished the principal supply, though with a 14 in. by 16 in. by 12 in. compressor it was difficult to keep a pressure of 20 lbs. per square inch at the station. Lately the situation has been relieved by the extension of a 12-inch low-pressure main for a distance of two miles through the principal thoroughfare, with direct connection to a 20-inch feeding-line. All laterals have been connected, thousands of feet of 2-inch mains replaced with 4-inch and 6-inch, and many dead-ends eliminated. A new 16 in. by 17 in. by 20 in. compressor has been installed; and during peak hours a pressure of 30 lbs. is maintained at the station. Two Chaplin-Fulton district governors are located at suitable points and set to keep a pressure of not less than 5 inches in the distributing system. The service now is very satisfactory, and complaints have dropped to normal.

Sloping to the ocean beach, south of Golden Gate Park, lie the Sunset and Parkside districts. The soil here and in Richmond is composed of clean, wind-blown sand, which has been swept in from the beach over barren dunes, and piled in shifting drifts and ridges. During the season of westerly trade winds, a trench left open at night in any exposed location will be filled with sand, and all traces of its existence obliterated before the following morning. Pipe laid in this ground lasts about as long as when stored in a warehouse. Near the beach, however, unprotected wrought-iron pipe is affected by the corroding action of both salt and fog.

The Sunset district is supplied by means of a low-pressure system, boosted at peak hours by high pressure from a 2-inch main extended from the high-pressure line in Richmond. This main also runs on southerly to the newly-built settlement of Parkside, which is the only exclusively high-pressure district in San Francisco. About 75 houses are supplied by means of ½-inch services, No. 1 Equitable governors, and ordinary 5-light meters. The installation gives less trouble, and the district is the source of fewer complaints, than any other of equal area in the city.

The Mission is a densely-populated residential district. This and the Potrero, in the south-easterly corner, are supplied from the 24 and 30 inch trunk lines by 10, 12, and 16 inch feeding-mains and the usual network of smaller pipes. Lead joints are used exclusively throughout the whole system of cast-iron mains.

House services vary in diameter from 1 inch upwards. Nothing less than 1¼-inch has been installed during the past ten years, though thousands of smaller services (relics of former times) are still in use. Present practice favours generosity in regard to sizes. The constantly increasing use of gas appliances demands 1½ and 2 inch pipe in houses which formerly could be supplied by means of 1 to 1¼ inch. Where water-heaters are in use in addition to the customary burners for illumination, it has been found advisable in many cases to instal separate services to supply heaters which require a rapid flow of gas. When lights and heaters are supplied from a single service, the irregular demands of the heaters cause quick variations of pressure and flickering lights unless the service is extravagantly large. Two 1½-inch services are cheaper to instal, and give better results, than a single 2½-inch service. A 1¼-inch service costs only 10 per cent. more than a 1¼-inch; while the difference in capacity is 40 per cent. The larger service, moreover, has advantages apart from mere capacity. It is not so easily choked or trapped as the smaller sizes, both pipe and fittings are stronger, leakage is reduced, and the life of the service lengthened.

During the last few years, particular attention has been devoted to the matter of meter locations. It is required that in every new building a suitable place shall be provided for gas-meters in the part near the street, and not higher than the ground floor, where light and ventilation are good, where the meters may be reached easily by inspectors, where they are accessible in case of fire, and where the service-pipe can be run to them without elbows, bends, or traps. About 200 old services are being overhauled per month and larger pipe installed, bends and drips removed, and meters reset in accordance with the conditions just outlined.

Meters range in size from 3-light to 200-light; and the 3-light, 5-light, and 10-light sizes are set with lead connection—all larger than the last named having iron connections. The use of 3-light meters is being discontinued in favour of 5-light ones. Under average conditions, the life of a meter is six years. If kept in commission for a longer period, it is liable to become inaccurate and leaky, or break down altogether. After six years' use, the leather diaphragms are generally dry and hard, the oil having been evaporated, and the meter becomes "slow," or possibly fails to register. To simplify the regular changing of meters, they are painted a different colour each year.

Street-lamps have 1-inch services and ¾-inch rising pipes. They are provided with Welsbach mantles, which are supplied and maintained by the Welsbach Company under a contract with the Gas Company. Of the 5000 lamps in use, 340 are "triple tops"—*i.e.*, a cluster of three lamps supported by a single post.

The subject of complaints is the liveliest storm-centre in all the affairs between a gas company and the general public. This is a remarkable condition, in view of the fact that the desires of the complainants and the interests of the company are identical. However far apart the principals may be regarding rates, or whatever differences of opinion may exist between them concerning the accuracy of a meter or the equity of a bill, they meet on common ground when it comes to the complaint question. Nine times out of ten the consumer wants more gas and ten times out of ten the company are eager to accommodate him. The only difficulty hinges upon their ability to furnish a satisfactory supply quickly enough.

Ninety per cent. of consumers' complaints are on account of poor pressure, caused by naphthalene in the service-pipes or the meter connections. A little gasoline blown through the service with a force-pump is ordinarily sufficient to clear the pipe. Particularly stubborn cases require that the services shall be overhauled and thoroughly cleared by mechanical means. Some months ago, a 6-inch service supplying a local cannery became badly choked, and was cleared by disconnecting the pipe at the main and blowing it out with steam by means of a hose connected to the boiler.

Climatic conditions in San Francisco are particularly favourable for the rapid formation of naphthalene in service-pipes and meters that are exposed to the air. From May until October the forenoons are usually warm and clear, followed by a cool sea breeze with banks of fog in the afternoon. The change of temperature is sufficient to affect exposed services, and start an avalanche of complaints of poor pressure.

In the congested district of San Francisco, street conditions below the surface are somewhat discouraging. From kerb to kerb, to a depth of from 6 to 10 feet, the space is filled with iron, brick, and concrete structures. The street railroad right-of-way covers 18 feet. Into the remaining space are packed telephone, telegraph, electric light, and power conduits, with manholes up to 10 feet square; gas and water mains and services, with valves and drips; sewers and manholes, catch-basins and laterals; an occasional steam line; and numerous abandoned pits formerly used in connection with cable railways. In crossings, the city authorities are building water-cisterns 34 feet diameter; and the Gas Company have been politely advised by the City Engineer to remove their mains from the areas of the cisterns.

During the last half century, fewer changes have been made in the distributing system than in any part of the Company's plant. The construction of the works, the material used, and the methods of manufacture, have all undergone radical changes; even the office methods have been revolutionized. With gas made from a new material, by a new process, and consumed in burners embodying newly discovered principles, the means used for delivery have remained practically the same for a period of fifty years. In all probability, before the next meeting of the Association, this apparently unchangeable equipment will have joined the general march of development towards greater efficiency.

Plans have been prepared for the installation of a 16-inch high-pressure gas-main from the Potrero station to the North Beach station, designed to carry gas under a pressure of 40 lbs. per square inch. Five district governors are to be located at points from which the Mission, Sunset, Richmond, western addition, and business districts can all be furnished with a supply of gas far in excess of present demands, and this without adding to, or materially altering, the existing low-pressure system. The plan is to change the catenary curve of a long chain to practically a horizontal line by means of equi-distant supports between the abutments. When this has been accomplished, peaks will lose their terrors, and the increase of gas consumption in San Francisco will be anticipated for fully fifty years to come.

Conversion of Ordinary into Prepayment Meters.—In the course of a paper on "Experience with Prepayment Meters" read by Mr. Frank Hellen, the Superintendent of Gas Distribution for the Rochester (N.Y.) Railway and Light Company, at the last annual meeting of the Empire State Gas and Electric Association, he stated that they had 5000 old three-light meters which had been practically set aside as worthless. Since adopting the prepayment system, they had converted these meters into slot-meters, and they were being set up for small consumers. He pointed out to his hearers that if they considered the fact that the Company had installed 6000 prepayment meters since Jan. 1, 1908, they would readily understand that a great saving was effected by the conversion of the 5000 old meters.

BENZOL ENRICHMENT OF GAS.

As mentioned in the course of the notice of the proceedings at the last annual meeting of the American Gas Institute which appeared in the "JOURNAL" for the 9th of November, the Committee on Benzol Enrichment presented a report on the result of their labours. We have received from the Secretary (Mr. A. B. Beadle) a copy of the report, and take therefrom the following observations.

On investigating the use of benzol as an enricher of illuminating gas, the Committee found that, as the result of its being manufactured mainly in bye-product oven plants, by far its most important use in America as an enriching material had been to raise the candle power of the coal gas obtained in the manufacture of coke. The companies producing bye-product oven gas made a careful study of the practical conditions governing the enrichment of their product by the use of commercial benzol; and the Committee received communications from Mr. Warren S. Blauvelt, at Detroit, and from Mr. L. M. Whitwell, at Milwaukee (Wis.), both connected with the Semet-Solvay Company and members of the Committee, giving some of the results of such study. These communications are appended to this report as an appendix. The Committee say that perhaps the most important work done by the Company was the confirmation, in practical work, of Dr. Bunte's figures showing the varying enrichment value realized from benzol in candle-feet per gallon depending upon the quantity of benzol carried by the gas.*

The Committee call particular attention to the fact that enrichment by benzol adds but little to the heating value of the gas enriched. The addition of 0·1 gallon of benzol to 1000 cubic feet of gas increases its heating value by only about 12 B.Th.U., even when no low-tension vapours are thrown down; and, since the heating value of gas is to-day at least as important as its illuminating power, the first essential for the successful use of benzol enrichment is that the gas must already have a satisfactory thermal value. For this reason benzol can never entirely replace gas oil for the enrichment of water gas; the approximate quantity of 1 gallon required to raise 1000 cubic feet of "blue" water gas to 21 or 22 candle power would only bring up the heating value to about 425 B.Th.U. per cubic foot. On the other hand, coal gas, whether made in coke-ovens or in retorts, is comparatively low in illuminating power, but possesses the necessary initial heating value to make it suitable for enrichment by benzol. The Committee consider that benzol may have an important value as an enricher for water gas in cases where sufficient oil has been used in the manufacture of the gas to give it the necessary heating value, but where the candle power has been reduced by the loss of hydrocarbon vapours due to cooling or compression.

Practical results confirm theory in condemning the use of benzol to enrich at the works any gas already saturated with hydrocarbon vapours. The low-tension vapours will be deposited in transmission to a greater or less extent, depending upon the temperature and pressure conditions; and the final candle power reaching the consumer is likely to show that a very disappointing enriching value has been realized for the benzol used.

The Committee received a report from a works manufacturing one-third water gas and two-thirds coal gas, covering a full year's use of benzol to replace a portion of the gas oil formerly used. The enriching was done at the works, and the report showed an average enriching value of about 28,000 candle-feet per gallon of benzol. However, as the quantity of street drip was increased by the use of benzol, it is probable that the enrichment value, measured by the candle power at the point of consumption, was much less than that shown by the candle-power readings at the works.

The Committee point out that to ensure a permanent and commercially successful increase in candle power by the use of benzol, it is usually necessary to prepare the gas by removing a portion of the low-tension hydrocarbon vapours. This may be done by compression, by cooling, or by washing the gas with an absorbent oil. Mr. Blauvelt in his paper describes the latter method as it is carried out at Detroit; Mr. Whitwell gives the results obtained at Milwaukee in the enrichment of coke-oven gas after compression to from 1½ to 2 lbs.

The conditions controlling the commercial success of benzol enrichment are, the Committee state, the comparative costs of this material and gas oil, and the quality of benzol available; the initial candle power and heating value of the gas to be enriched, and its condition with respect to saturation with hydrocarbon vapours and the character of such vapours; and the conditions of temperature and pressure to which the gas will be exposed after enrichment. These factors having been determined, they consider there are sufficient data available, both practical and theoretical, to make it possible to give a close estimate of the probable results to be obtained by enrichment with benzol. They conclude by expressing their conviction that there are many cases where such enrichment has practical and economic advantages over any other method, but that each case constitutes a separate problem requiring careful study.

In the course of his paper, Mr. Whitwell gives the following figures to show the amount of enriching benzol required to produce various ultimate results from certain initial candle powers.

* See "JOURNAL," Vol. LXII., p. 717.

To Produce 16-Candle from 10-Candle Gas.

Initial Candle Power. Due to Benzol.	Initial Candle Power. Not Due to Benzol.	Quantity of Benzol to be Used per 1000 Cubic Feet.	Candle-Feet per Gallon.
10	0	0·310 gallon	19,300
8	2	0·230 ,,	26,000
6	4	0·190 ,,	31,500
4	6	0·160 ,,	37,500
2	8	0·140 ,,	42,900

To Produce 18-Candle from 14-Candle Gas.

Initial Candle Power. Due to Benzol.	Initial Candle Power. Not Due to Benzol.	Quantity of Benzol to be Used per 1000 Cubic Feet.	Candle-Feet per Gallon.
14	0	0·300 gallon	13,300
12	2	0·240 ,,	16,600
10	4	0·165 ,,	24,200
8	6	0·135 ,,	29,600
6	8	0·120 ,,	33,300
4	10	0·105 ,,	38,000

Referring to the second table, Mr. Whitwell says: "The above case of raising 14-candle to 18-candle gas may explain some of the widely different results which have been obtained in various works where benzol enrichment has been experimented with, even though no troubles were experienced with deposition of oils after enrichment. For instance, assuming that a mixture of equal parts of coal gas and water gas of 14 and 22 candles respectively was yielding a finished gas of 18 candles, and it was desired to reduce the candle power of the water gas by substituting benzol enrichment, the measure of the success of the change would, of course, depend on the candles obtained per gallon of benzol. Assuming that 14-candle instead of 22-candle water gas is made, then the enrichment is to be 4 candles of benzol added to a half-and-half mixture of coal gas and water gas of 14-candle power. Upon the composition of the 14-candle gas, as to the ratio of the candle power due to benzol to that due to true gases, would depend the enriching value of the benzol used. From the above table it is seen that this enriching value may vary from 13,000 to 38,000 candle-feet per gallon. If the water gas is such that a large portion of the 14-candle power is due to its content of condensable oils, much lower results would be obtained than if a large portion of the 14-candle power is due to the gases, ethylene, &c. The same is true of coal gas. It is therefore very apparent that the quality of the gas to be enriched is of quite as much importance as the quality of the benzol to be used. Apart from the carrying properties of the benzol, the proportions of the candle powers of the initial gas which are due to oils and to true gases are to be taken into account."

In the course of some further remarks, Mr. Whitwell says: "Considering the above figures of the possibilities of benzol enrichment of 14-candle to 18-candle power gas, it is seen that there are opportunities for realizing very cheap enrichment. For instance, in the case of a half-and-half mixture of coal gas and water gas, in which the water gas is so made that the mixture contains 8-candle power due to oils and 6-candle power due to true gases (ethylene, &c.), it is possible to realize 29,000 candle-feet per gallon of enriching benzol. These conditions show that it is essential, in attempting to use benzol enrichment, to investigate very carefully the gas to be enriched, and that the process can be a success or failure dependent on the quality of the gas, regardless of the quality of the enriching benzol to be used. It is thus not rational simply to reduce the oil used in water-gas machines, and substitute benzol enrichment, but very careful work should be done to make the water gas best suited to the conditions. In the enrichment of coal gas alone the same conditions are essential—viz., that, to secure the best results from benzol enrichment, those methods should be employed in retort and condensing house practice by which the maximum ratio of the candle power due to true gases to that due to oils will be realized."

In a subsequent part of his paper, Mr. Whitwell refers to the benzol enrichment of high-pressure gas. He points out that such enrichment at the delivery end of high-pressure lines is simply a proper application of fundamental principles, as the benzol is added under the condition in which it will be retained according to physical laws, and as it is found to be retained in actual practice. At Milwaukee, benzol is added to the gas after 1½ miles of transmission under about 2 lbs. pressure, so that a small portion of the tension oils has been deposited before enrichment. The gas is then tested two miles beyond the point of enrichment. Mr. Whitwell gives the following operation results, obtained during four months last year, as being of interest:—

Month.	Initial Candle Power at Ovens.	Enriching Benzol Used per 1000 Cubic Feet of Gas.	Candle Power after Transmission.	Candle-Feet per Gallon of Benzol.
February	9·14	0·40 gallon	17·19	20,201
March	9·59	0·39 ,,	17·40	19,876
April	10·02	0·42 ,,	17·00	16,517
May	10·15	0·40 ,,	17·42	17,915
Average	9·72	0·40 gallon	17·25	18,627

The enriching values of the oil used at Milwaukee are determined from the candle power of the gas as it leaves the condensing house at the ovens, as compared with that possessed by it after transmission. That is to say, the enriching value represents the enrichment of the gas, not as put into a holder at the works, but as delivered over two miles at a temperature of 35° to 40° Fahr.,

and pressures up to 2 lbs. per square inch. Mr. Blauvelt presented the results at Detroit, which show that, with gas better prepared for benzol enrichment, but still carrying a total benzol content about the same as Milwaukee, considerably higher enriching values can be realized, and practically no loss sustained in transmission.

Mr. Whitwell concludes by saying that a fair consideration of the possibilities of benzol, with due consideration of the conditions which affect the retention of this enriching medium, brings out very clearly the conclusion arrived at by Mr. E. H. Earnshaw, in his paper on "The Theory of Benzol Enrichment," read at the meeting of the Institute in 1908,* "that every case in which it is desired to use commercial benzol as an enricher must be treated as an independent and separate problem, and considered in the light of known laws." It is evident that practically no two operations need the same treatment in order to give the most economical results. In one case a small loss in transmission might be more economical than the cost of the removal of the low-tension oils at the works, whereas in another case exactly the opposite might be true. Similarly, the costs of obtaining the desired results must be set one against the other in any case; but Mr. Whitwell considers that the results which have been obtained surely indicate that, if properly handled, there are opportunities in many instances for remarkably economical enrichment by the use of benzol.

The following particulars in regard to the enrichment operations carried on at Chester (Pa.) were furnished by Mr. C. Rodman Stull.

At Chester (Pa.), the Suburban Gas Company operate water-gas plant and bye-product coke-oven plant. The latter is situated about 1¼ miles from the former, so that the coke-oven gas has this extent of travel before it is mixed with the water gas. All the gas evolved from the coal charged into the ovens is used for distribution to the consumers; the gas required for heating the oven flues being derived from an independent producer installation. This method of operation, together with the general system of oven charging employed, is productive of widely varying results from the standpoint of quality of gas received. As an illustration of this, the illuminating power will range from 17 candles immediately after charging to 1 candle towards the end of the coking period; the heating values varying approximately between the limits of 650 and 550 B.Th.U. per cubic foot. This fact will in itself explain some of the variable results obtained with benzol enrichment. Another feature in the operation is the presence of water gas in different portions in the mixture to be enriched.

The gas from the coke-ovens, after its travel through a 10-inch main 1¼ miles long, is metered ahead of the purifiers, and before being added to the water gas; the two gases being mixed in the boxes. The illuminating power of the water gas, when this is to be mixed with the coke-oven gas, is kept at approximately 20 candles. This value was determined upon, after experiment, as yielding the best economic benzol effects on the mixed gas. Some attempts to carry it below 18-candle power gave very poor results. The 20-candle value allows for 1 or 2 candles enrichment from the water gas, depending on the proportion of the mixture, which, in turn, determines the candle power of the gas to be delivered to the consumers. We have not had any considerable amount of experience with benzol enrichment on the straight water gas, except in the months of April and May, 1908, during which time we obtained an average of 21,900 candle-feet per gallon of benzol. The process was discontinued, however, on account of the poor carrying qualities of the water gas so treated.

After being mixed in the purifiers, the gas is enriched with benzol. The carburettor used is of a simple type; the oil being vaporized by steam. Candle-power readings are taken hourly on the gases before and after enrichment; and the finished power is read directly from the line at the outlet of the governors. This allows for a certain amount of condensation between the carburettor and this point; the major portion probably taking place in the holder inlet-pipe and the commercial holder itself. It is a very noticeable fact that enriching values vary considerably, due to this phase of the operation. During the winter months, a large amount of condensate gathers on top of the water in the holder tank, which vaporizes during the warmer weather, and practically automatically enriches the gas. This means that after enrichment there are present in the gas certain hydrocarbon vapours of such low tension that their condensation takes place when the gas is chilled in the holder; this condensate revaporizing when the temperature of the gas increases to the proper point for such action to take place.

At the time of writing, we are experiencing a condition of higher candle power on the end of a 9-mile high-pressure system than at the holder station. The gas being pumped is all coke-oven gas, where previously it was a mixed gas. This condition can be explained in the same way. A comparison of drip-oil tests will tend to corroborate this statement; some of the higher-tension oils having been condensed in pockets along the line during the winter months. It is quite likely that the coal gas contains a lower percentage of illuminating power due to benzol and more to fixed gases, and for this reason is better able to absorb a greater proportion of the oils in the line than was possible with water gas. The following table gives a survey of operations for six months.

* See "JOURNAL," Vol. CIV., p. 907.

Month.	Temp Air.*	Candle Power. W.G.	C.O.G.	Mixed.	Candle-Feet.	Darby C.P.	Drop.
February	38	20·0	7·6	17·3	18,900	12·7	5·6
March	38	20·2	8·1	16·9	18,900	15·2	1·7 (*a*)
April	50	19·0	7·0	16·8	34,100	16·1	0·7 (*b*)
May	61	20·1	8·0	16·8	52,500	16·1	0·7
June	71	20·8	6·5	19·0	27,600	15·2	3·8 (*c*)
July	74	19·8	6·5	19·0	30,100	17·1	1·9

(*a*) Less water gas than in February; and better grade of oil. (*b*) Less water gas than in March; and increase in air temperature. (*c*) Excess of water gas over coke-oven gas.

Looking at the February and March figures, it will be noticed that the enriching values for these months are identical, as well as the atmospheric temperatures. The carrying capacity of the gas, however, was increased. This may have been due to two causes—a decrease in the percentage of water gas in the mixture, and the use of a higher-grade benzol (about 82 against 78 per cent.). With April, the enriching value per gallon went up to a high figure—viz., 34,100 candle-feet. With this there was an increase of 12° Fahr. in atmospheric temperature for the month. There was also a further decrease in the percentage of water gas in the mixture. The average benzol consumption per day was less than in either February or March, along with lower initial candle-power values—showing that some of the condensate collected in the holder was being revaporized and enriching the gas. The increased carrying capacity of the gas under high pressure is to be noted. For May, a still higher value was realized; this being done with a rise of 11° Fahr. in atmospheric temperature and a slight increase in the percentage of water gas in the mixture over the previous month. In June, the water gas in the mixture exceeded the coke-oven gas; the results showing a decrease in enriching value. The figures for July show an enriching value of 30,100 candle-feet per gallon, under conditions which closely approximated those of the previous month.

SCOTTISH JUNIOR (WESTERN) GAS ASSOCIATION

Visit to the Bedlay Colliery.

Last Saturday afternoon, the members of the Western District Division of the Scottish Junior Gas Association paid a visit to the coke-ovens at the Bedlay Colliery, near Glenboig. There was a gratifying attendance; the company numbering about sixty. They were received at the works by Mr. J. Robertson, the Manager of the coking department, and by him and two assistants were shown round. The works are entirely new, having been opened in April, 1908. Everything in and about them is consequently of the most modern description; and the knowledge of this fact was one of the reasons for the large attendance.

The coal which is got at Bedlay is of a high coking quality, being somewhat similar to that which is found at Auchengeich, near Kilsyth. It is largely sold for gas-making; and it is only the small stuff that is sent to the coking department. It is first washed, then hammered by machinery into pieces about the size of a pea, and sent on a belt conveyor to the charging-machine. As the coal trickles into the machine, it is rammed into a solid mass by heavy stamping machinery of an ingenious description. The mass of coal is pushed into the retort, where it remains for about 24 hours, after which it is pushed out on to a sloping platform. As it emerges from the retort, the coke is quenched by a spray of water from an overhead pipe. At the foot of the slope it falls into a conveyor, which takes it away to the screening plant. The retort-bench is on the Semet-Solvay system, and contains thirty retorts, each 30 feet long, 2 feet broad, and 7 feet high; their capacity being 7 tons of coal each. There is a high yield of coke. The charging and discharging machinery is electrically driven. The gas which comes off is sufficient for the firing of the retorts and the tar-stills; and there is then a surplus which can be used in firing steam-boilers. The gas is drawn off by a Waller exhauster, placed after a very extensive range of vertical pipe condensers. After the exhauster, the gas is washed and returned for fuel. The bye-products are worked up—the tar into benzol and pitch, and the liquor into sulphate of ammonia. Of the latter, there is a very high yield.

At the close of the inspection of the works, tea was served in a store-room. After tea, the President (Mr. D. Currie, of Stirling) asked the members to accord to Messrs. Baird and Co. their hearty thanks for the great privilege they had granted the Association in allowing them to visit their magnificent works. At the present time, when so much was being said about carbonizing coal in bulk, the visit to Bedlay to inspect the coke-ovens had certainly proved very interesting, as it had given the visitors an idea of what could be done in the way of dealing with coal in large quantities. The President also asked the members to express their thanks to Mr. Robertson, and to Messrs. Buchanan and Hanson, for the courteous manner in which they had shown them through the works.

On behalf of the Company, Mr. Robertson returned thanks for the vote, saying he was certain the General Manager (Mr. J. T. Foyie) would have done had he been present. He hoped the visit had proved interesting. There was a difference between carbonizing 7 tons of coal and only a few hundredweight; but the trend of the day seemed to be to adopt vertical retorts, and carbonize in large quantities.

HYPOCHLORITES FOR WATER PURIFICATION.

A recent number of the "Proceedings" of the American Philosophical Society contained the following article, by Dr. W. Pitt Mason, on "Purification of Water Supplies by Hypochlorites."

There is no question but those of us who have taken ground as opposed to the "disinfection" of water by "bleach," hypochlorite of sodium, or other similar substances, must change our position. The experimental work in France and England, the improvement of the water of Bubbly-Brook at the Chicago Stock Yards, and, above all, the remarkable results secured by the Jersey City Water Supply Company, when operating upon the entire municipal supply of Jersey City, suffice to silence opposition to what may be termed the most recent purification method of to-day.

It is true that some years ago the Woolf process was proposed, whereby an electrolyzed salt solution was employed for addition to either sewage or water; and still farther back the Webster plan was advocated. But none of the hypochlorites was exploited in the systematic and exhaustive manner that has been recently accomplished, nor has the smallness of the dose that will accomplish efficient treatment ever been suspected. Let the following facts speak for themselves.

Lake water was treated with increasing doses of bleaching powder equivalent to the amount of available chlorine indicated. It was then allowed to stand three hours in the dark, shaken, and sowed for "total count" of bacteria.

Dose of Bleach.		Bacteria per Cubic Centimetre.
Grains per Gallon.	Parts per Million.	
0	0	102,900
3/100	0·51	410
1/20	0·85	320
1/10	1·70	175
1/8	2·12	100
1/4	4·25	95
1/2	8·50	45

Numerous similar sowings were made, and even lower counts of residual germs were found.

Upon examining waters charged with pure cultures of *Bacillus coli communis*, and others contaminated with fresh fæcal material of human origin, no gas-forming bacteria of any kind were found alive in any instance after the use of even the smallest dose of "bleach" shown above.

Other experimenters have arrived at similar conclusions with still smaller doses of "available chlorine." The most satisfactory test of the process, however, is the practical one of treating the entire municipal supply daily furnished to Jersey City. The dose there used during the month of December, 1908, averaged approximately 0·03 grain of available chlorine per gallon. It has since been materially reduced. While using the above-named amount, the daily counts of bacteria for the month were—

	Raw Water.	Treated Water.
Maximum	1600	30·0
Minimum	240	..
Average	559	2·7

No part of this minute dose of hypochlorite reaches the consumer, and protection against pathogenic organisms appears to be assured.

It is not expected that the process will take the place of filtration, because it does not aid in improving the physical appearance of a water. But as an adjunct to a filter plant, there can be no question of its usefulness in times of emergency; and it can surely be depended upon to render a reasonably polluted water safe for domestic purposes, and do it at a moderate price.

It goes without saying that the hypochlorite of sodium, obtained by electrolyzing a solution of common salt, can be substituted for the bleaching powder whenever local conditions allow of its cheap manufacture. The effect upon bacterial life is the same.

We have received from the Editor (Mr. S. Edgecumbe Rogers) the "Local Government Annual and Official Directory" for the current year. The main portion of the book is devoted to the directory, which gives the names and addresses of the chief officials of all the corporations and local and other authorities throughout the kingdom, as well as a list of the Borough Councils and City Companies of London. In addition to the directory, there is a quantity of information relating to electric light undertakings in the London boroughs; the charges for gas and water are shown; and there is a useful abstract of the local government legislation in 1909.

The following is an extract from a paper read by Mr. R. Hammond before the Institution of Electrical Engineers: "In regard to the metallic filament lamp, I am thoroughly with those who believe that it is a magnificent thing for the industry. We have been saying for the past 20 or 25 years that we should entirely abolish gas if, by various methods of economy, we could produce electricity cheap enough. We have made a fight against gas through all these years; and at last we find ourselves in a position, with the metallic filament lamp, of being able to supply electricity in England at practically a cheaper price than that at which gas is supplied. We have talked about shutting up the gas-works in England for a great many years; and I would like to say to the gas managers that the invention of the metallic filament lamp makes their tenure a very short one."

LARGE STEEL PIPE-LINE FOR BROOKLYN.

A recent number of "Engineering Record" contained a long illustrated article on a 72-inch steel pipe-line which has been laid in augmentation of the Brooklyn (New York) water supply The following are some particulars in regard to the work.

The borough of Brooklyn takes its water supply from wells, infiltration galleries, and ponds stretching over a distance of 23 miles along the south shore of Long Island, and extending eastward to the Suffolk County line, about 30 miles eastward. The water is drawn from the wells, galleries, and ponds by pumps in 24 isolated stations, and delivered into large trunk mains, which, with the exception to be noted, have gravity flow. The trunk mains have gradually been added to as the consumption of water has increased, until at the present time they include the following lines: A brick conduit seven miles long from Massapequa westward to the Millburn pumping-station; three 48-inch cast-iron pipes therefrom westward to the gate-house west of the Millburn reservoir; two 48-inch cast-iron mains, 12½ miles long, from the reservoir to the pump-well of the Ridgewood reservoir pumping-station; and, finally, a 36 inch cast-iron pipe from the Millburn reservoir to Smith's Pond, where it connects with a brick conduit running to the pump-well at Ridgewood. The brick conduit from Massapequa to the Millburn pumping-station increases in capacity from 41 million gallons per day at the eastern end to 59 million gallons at the western end; the increase being required by the tapping of additional supplies. The three 48-inch cast-iron pipes from the Millburn pumping-station to the Millburn reservoir are force mains for overcoming the summit at that point; this being the exception to gravity flow above noted. The brick conduit from Smith's Pond to the Ridgewood reservoir pumping-station increases in capacity from 41 to 76 million gallons in its westward course. Through this system, about 125 million gallons of water a day are delivered to the city in the summer months; and of this quantity all the water from stations east of Baldwin, where the Millburn pumping-station is located, is pumped three times before reaching the distribution system—first, in being taken from the source and delivered to the brick conduit; secondly, in being raised by the pumping-station over the hill at this point; and, thirdly, in being raised to the Ridgewood reservoir.

It became apparent some years ago that a further increase in the supply was necessary; and, accordingly, the Department of Water Supply, Gas, and Electricity, having charge of the Brooklyn water system, determined on an increase in the number and capacities of its sources and pumping-stations, and in the means of bringing the additional supply to the Ridgewood reservoir, which is the main distributing centre of the city distribution system. The new trunk main decided upon was a 72-inch steel pipe 24½ miles long, to be operated as a force main delivering direct to the distribution system, and discharging the excess supply by an overflow connection into the Ridgewood reservoir. Its capacity will be from 50 to 60 million gallons per day. The main stations operating this line are now under contract, and are located at Massapequa and Wantagh; and at these points, 20½ and 18½ miles respectively from Ridgewood, additional infiltration galleries will be built. Moreover, there are in progress three 4 million gallon pumping-stations located at Rosedale, Rockville Center, and Baldwin, where new driven-well plants have already been built; and these stations will deliver under head directly to the new force main when completed. When placed in operation, the new line will save materially in pumping, by forcing the water at once into the distribution system, and, eliminating the second and third lifts at Millburn and Ridgewood, will relieve the heavy burden on these stations, and will increase the total capacity of the system. It will not, however, be sufficient to dispense with the older mains, but will afford a generous excess capacity; thus permitting one of them at a time to be thrown out of service for repairs, and allowing the duty upon them to be lessened. In accordance with these plans, work was begun about three-and-a-half years ago upon the first section of 72-inch line, and was completed in August, 1907. Since then it has been used to supplement the gravity flow in the older conduits; its grade being such that it could be thus operated with only a slight lift.

It was the intention from the first to extend the 72-inch pipe to the Suffolk County line; but lack of funds prevented its continuation immediately after the completion of the first section. However, in November, 1908, the remaining portion, about 16 miles—or, more exactly, 83,500 feet—was placed under contract, and work upon it is now under way.

The line eastward from Valley Stream is laid on a private right-of-way, in some places 100 feet and in others 200 feet wide. Being a pressure pipe, it is not laid on a gravity grade; the maximum gradient being 1 per cent. The maximum curve has a radius of 200 feet. In order to pass round curves, the ends of the pipes are cut to a suitable bevel. The line consists of a circular steel-plate pipe with an inside diameter of 72 inches, single-riveted circular joints, and longitudinal joints made with "lock bar." It was designed for an internal working pressure of 125 lbs. per square inch, with a factor of safety of 5 lbs. The plate is 7-16ths inch thick, made of steel, with an ultimate tensile strength, as provided in the specifications, between 52,000 and 62,000 lbs. per square inch, and an elastic limit of 30,000 lbs. The specifications regarding the lock bar provided that the edges should be upset by a hydraulic press exerting a pressure of not less than 500 tons; and the efficiency of the joint was considered to be 95 per cent.

The circular seams are joined with 1-inch rivets on 2¼-inch centres round the entire circumference.

The pipe is made up in lengths of 30 feet, each weighing approximately 12,000 lbs.; and each length is coated, while at a temperature of 350° to 400° Fahr., with a mixture of coal-tar pitch and oil. Each pipe is made of two plates, 30 feet long, each having a width equal to half the circumference, so that there are only two longitudinal seams. Previous to coating, each section is tested at the shop to a hydraulic pressure of 200 lbs. per square inch.

The coating required in the specifications is the same as that used upon the section of 72-inch pipe already completed east of Valley Stream; and in order to determine its efficiency, this pipe was drained and the coating carefully inspected, with the result that it was found to be in excellent condition. This mixture contains not less than 99·3 per cent. of pure bitumen, consisting of not less than 70 per cent. of petrolene, soluble in petroleum ether, and not more than 30 per cent. of asphaltene, soluble in chloroform. The specifications require that this coating shall be not less than 1-32nd inch and not more than 1-16th inch thick.

The pipe, in general, is laid in a trench having a maximum depth of about 11 feet. The valleys, of course, must be crossed on embankments. On these, and wherever the top of the pipe is near or above the natural surface, a minimum cover of 3 feet of earth is required over it; the top of this fill being horizontal and 6 feet wide, with side slopes of 1½ to 1 reaching the natural ground surface. The contract note requires that upon the completion of the backfill and the earth cover over the pipe, 4 inches of rich top soil of good loam shall be placed over all and seeded with grass.

The pipe is provided at intervals of about 3500 feet with 48-inch gate-valves, which accordingly require reducers to be placed on both sides of them in order to connect with the 72-inch line. These valves divide the pipe into sections that can be drained and isolated from the rest of the line. The adoption of 48-inch rather than 72-inch valves was, of course, prompted by the economy of the smaller size in first cost and in possible future repairs, while, in addition, their operation is easier. These valves, which are provided with 8-inch bye-passes, are connected with the 72-inch pipe by a succession of three specials—the first consisting of a cast-steel connecting-piece with a deep hub on the end away from the valve, then another cast-steel piece forming a spigot, and, lastly, a steel plate reducer riveted to the spigot, and connecting to the 72-inch line. The first of these cast-steel pieces has a 6-inch flange projecting from its body just inside the hub, in order to afford an anchorage within the concrete wall of the chamber. The bell of the cast-steel special is almost 10 inches deep, and the specifications require that it shall be run solid with at least 8 inches of lead. Both the interior of the hub and the exterior of the spigot fitting into it are grooved, in order to afford a grip for the lead. The spigot piece is 18 inches long. The reducer has longitudinal seams riveted instead of being made with a lock-bar. The gate chamber needs no further comment save that the four reinforced concrete cover slabs, measuring approximately 31 in. by 8 ft. by 10 in., and supported upon 8-inch I-beams, have the joints filled with a lean cement mixture, which can readily be removed when it is desired to take up a slab. Two manholes are placed in the top, allowing access to the chamber, and also providing for the insertion of the keys for opening and closing the main and the bye-pass valves.

Automatic cluster air-valves manufactured are placed at all of the principal summits; and at the other summits hand-operated 4-inch valves are used. The 8-inch cluster valves are enclosed in a chamber, and are mounted on the top of an ordinary 8-inch gate-valve; so that in case repairs are necessary to the automatic valve, it will not be necessary to shut down the entire section of pipe in which it occurs. Normally, of course, the 8-inch gate is open, and the accumulated air is dealt with by the automatic valve.

For draining the pipe, at least one blow-off is placed in each section. To facilitate inspection and construction, a manhole is placed every 1000 feet. They have oval openings measuring 14 in. by 16 in. in the clear, and are closed with a cover similar to those used on the manholes of steam-boilers. For convenience in passing hot rivets into the line and for the air-hose of the riveting-tools, a 2-inch hole is placed in each 30-feet length near one end, and on the completion of the work is closed with a screw-plug.

On account of the topography on the South shore of Long Island, the pipe necessarily crosses a great many small streams; and these have been carried under the line through reinforced concrete culverts. In a number of places interurban railroad lines and the Long Island Railroad were arranged to be carried over the main.

Liverpool and Automatic Lamp Lighting.—When the Liverpool City Council were discussing the estimates for the ensuing year, Mr. Muspratt said they had been told that £10,000 a year could be saved by the adoption of automatic lighting; and, if this was so, action should be taken at once to secure it. Mr. Walker remarked that it was quite true that when the automatic lighting was completed there would be a saving of £10,000 a year. The Council, however, only allowed them to instal 1000 of these lighters each year; and it would take, on this basis, twenty years to complete the improvement. Alderman Smith asked whether the Council would authorize the expenditure of such a large sum as would be needed to completely reorganize the system of lighting all at once. This would cost about £18,000. The Committee proposed to make the alteration by instalments, which was the only reasonable, prudent, and proper course.

REGISTER OF PATENTS.

Purification of Gas and Recovery of Bye-Products.

WILTON, G., of Mark Lane, E.C.

No. 23,043; Oct. 29, 1908.

The patentee remarks that in the manufacture of gas from the carbonization of coal the usual method adopted for the purification is first to cool the evolved gases by air-jacketed or water-jacketed pipes. The gas is then passed through a series of washers or scrubbers or both, for the removal of tar and ammonia; clear water being used in the washing or scrubbing plant to the extent of from 20 to 50 gallons per ton of coal carbonized. In general, ammoniacal liquor containing 1 to 2 per cent. of free and fixed ammonia is thus obtained. There is always a considerable quantity of water which condenses out with the cooling of the gas; the quantity obtained in the case of coal being equal to about 10 gallons per ton. This "virgin liquor" contains about 1 per cent. of free and fixed ammonia in the case of coal.

According to this invention, it is proposed to first treat this liquor (taken from any suitable part of the plant) with an alkali, for liberating the fixed ammonia; the alkali being preferably in excess. Then the liquor spray is otherwise introduced into the hydraulic main or the hot-gas main, where the gas still contains a substantial quantity of tar. The ammonia liberated from the fixed condition in the virgin liquor will preferably be conducted, together with the virgin liquor, into contact with the hot gases in the hydraulic main or hot-gas main. The greater part of the free and fixed ammonia is thus expelled from the liquor, and may advantageously be recovered from the gas by leading the gas into an acid solution (such as sulphuric or muriatic acid) in a washer or scrubber, whereby the ammonia is absorbed and a salt of ammonia is produced in the solution, which can be treated for the recovery of salts of ammonia. Or the ammonia may be absorbed from the gas in any other suitable way.

The hot virgin liquor after being brought into contact with the hot gas, as described, may be passed through a tar-separator and boiled with steam or direct fire for the removal of any remaining ammonia, which may be conveyed to the hot-gas main.

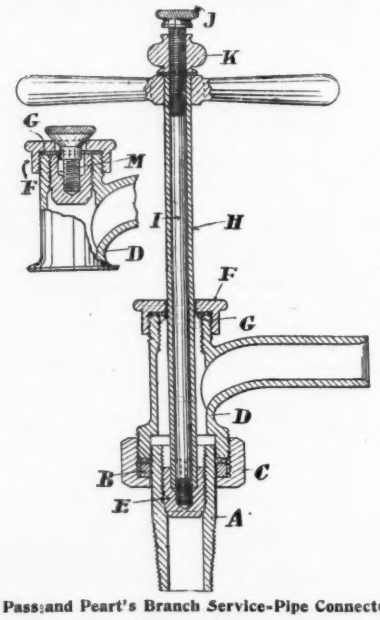
By the alkali treatment of the virgin liquor and the introduction of the treated liquor into the hydraulic main or hot-gas main as described, the whole, or the greater portion, of both the free and fixed ammonia contained in the virgin liquor is said to be recovered; the gases are reduced in temperature; and the deposition and mechanical mixture of the fixed ammonia with the tar in the hydraulic or hot-gas main is avoided.

Branch Service-Pipes.

PASS, E., and PEART, E., of Denton, near Manchester.

No. 27,397; Dec. 17, 1908.

This invention relates to branch service-pipes connected to gas and water mains, and is an improvement on patent No. 676 of 1905.



Pass and Peart's Branch Service-Pipe Connector.

In the prior invention, a short tube A was employed, screwed at its lower end for attachment to the main, and formed with a fixed collar B, which acted as an abutment for an internally threaded nut C used to connect the short tube A with the branch pipe D. For convenience in securing the tube A to the main, it is now proposed to make the collar B separate, with an internal screw thread, and form a screw thread on the tube A, so that the tube alone may be screwed into the main first, and then the loose nut C can be placed thereon, and, lastly, the collar may be screwed in position to act as an abutment to the nut. The tube A is provided with a seat, on which is screwed a valve E.

When the branch pipe has been secured to the tube A and the supply is to be turned on, the valve E is screwed off its seat and screwed into the tube formed above the outlet to the branch pipe. Difficulties are said to arise in effecting this, owing to the screw threads in the tube A

and the threads in the tube above the branch pipe D being interrupted by the fluid-way into the branch pipe. To overcome this, in addition to providing the valve E with means whereby it may be rotated by a key, it is formed with a screwed recess; and the tube on the branch pipe is provided with a screwed cap F, with packing leather disposed between it and the top of the tube to make a fluid-tight joint.

The key employed comprises a hollow spindle or sleeve H with a handle to rotate it; while within the sleeve is a spindle I projecting out of the external sleeve—the projecting ends being screw-threaded. The inner spindle is rotated by means of a knob J, or the like, to screw it into the hole in the valve E (as shown) and securely connect the valve to the inner spindle. When this has been effected and the rotating means on the end of the outer sleeve H have been brought into engagement with the recess in the valve, the internal spindle is secured by a milled nut K to the outer spindle or sleeve, which is then rotated to screw-out the valve plug E. When the valve plug leaves the screw threads (the valve being connected to the operating key by the inner spindle I), it can be safely lifted past the branch pipe outlet, where the screw threads are interrupted and easily screwed into the screw-threaded tube of the branch pipe D, above the outlet, until the upper part of the valve E beds against the leather below the cap F on the branch tube, as shown in the detail; the leather forming a fluid-tight joint.

To prevent the accidental displacement of the valve out of the branch tube by vibration, it is securely connected to the cap F by a screwed plug M passing through the cap and screwed into the top of the valve E; the plug having a conical head M^1 bedding on the cap.

Incandescent Gas-Filaments.

LAIGLE, R., of Paris.

No. 28,435; Dec. 30, 1908. Date claimed under International Convention, Jan. 10, 1908.

This invention relates to the manufacture of infusible and indestructible incandescent gas-filaments, of the kind described in patent No. 3785 of 1908—consisting in the use of at least one of the agglutinants, arabin or ammonium oleate, in the mixture employed for the manufacture of filaments of the kind referred to.

The filament is obtained from a plastic paste consisting of a mixture of the rare-earth oxides of thorium and cerium—a small proportion of oxide of beryllium acting as a binder; and of at least one of the agglutinants, arabin or ammonium oleate. The paste may also contain other substances—such as alumina, silica, and silicate of aluminium.

The filament is obtained by passing the plastic paste through a draw plate. For calcining the filament, it is subjected to a regular temperature, which is equal or slightly superior to the melting point of the oxide of beryllium.

The following composition of the paste is given by way of example:—

Oxide of thorium	92·80
Oxide of cerium	1·20
Alumina precipitated by ammonia	3·00
Silica, or silicate of aluminium	1·00
Oxide of beryllium	2·00

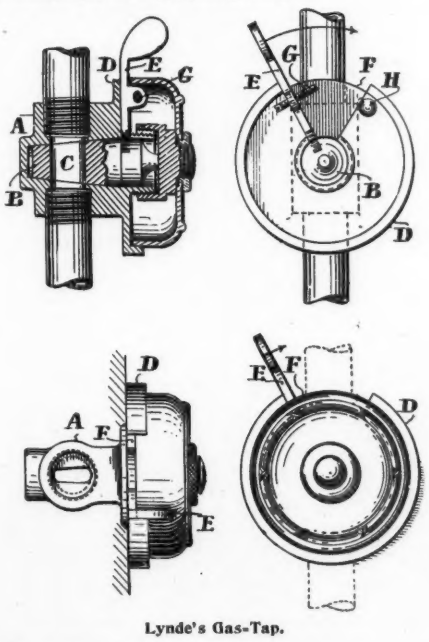
The agglutinant substances are incorporated in this composition.

Gas-Tap.

LYNDE, F. C., of Withington, near Manchester.

No. 53; Jan. 1, 1909.

This invention relates to a gas cock or tap primarily intended for controlling the supply of gas to a burner or burners at a distance, and which may, when desired, either completely close or cut off the gas port or supply, or may, when in its closed position, still permit the passage of enough gas to keep a pilot-jet alight.



Lynde's Gas-Tap.

The tap is illustrated in vertical cross section, its base part in elevation, in plan in place in a wall with the supply pipe removed, and in front elevation.

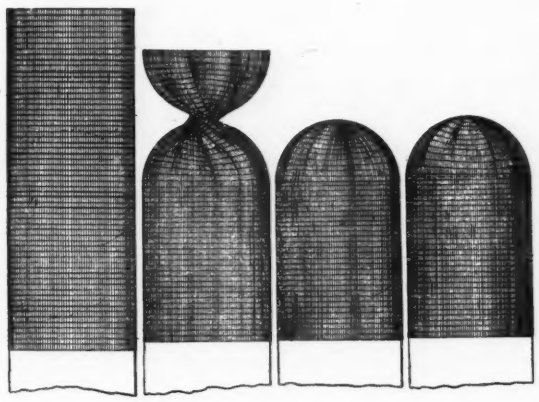
A is a tubular casing for the gas; and across it is placed the plug B formed with the transverse opening C in the usual manner. Combined with the casing is a circular base-plate D, through the centre of which the end of the tap plug projects. Radially secured to this end of the plug is an arm or finger E, by means of which the plug may be partly rotated to open or close or vary the area of the passage through the tap. The arm moves within an angular recess F in the face of the plate; the sides of the recess approximately radiating from the centre of the plate. The arm may carry a screw G adapted to come against a stud H in the closing movement of the arm in the direction of the arrow. By turning the screw in one direction or the other, the part of it which projects from the arm may be lengthened or shortened; and the closing movement of the arm may be regulated by the contact of the end of the screw with the stud, so as either to close the gas-passage altogether or to leave any desired amount of opening when the plug is in its most closed position for the supply of gas to a pilot-light.

Incandescent Gas-Mantles.

ROBIN, J. I., of Tooting.

No. 71; Jan. 1, 1909.

This invention relates to the manufacture of incandescent gas-mantles (upright and inverted), and more particularly to the closing of the fabric to form the tip or dome, instead of employing a thread of asbestos, which "does not become so incandescent as the fabric of the mantle," and so "detracts from the appearance and illuminating power." The invention consists in closing the mantle by twisting the fabric at the part where the apex or tip is to be formed; in spreading or folding-back the portion of the stocking beyond the twist; and in reversing the stocking after it has been so treated and without allowing the twisted portion to become untwisted.



Robin's Incandescent Mantles.

The illustrations show diagrammatically four steps adopted according to one mode of carrying out the invention in the manufacture of an inverted incandescent mantle. Although in this example the stocking is reversed after it has been twisted and spread back, the reversal may be omitted if desired; but in such case the top portion would probably have to be stitched, pasted, or otherwise secured to the main portion to prevent it falling away from it in use. It is found that this method of manufacturing a mantle may be "very rapidly carried out without requiring any appreciable skill on the part of the operators; so that a very great saving of labour is effected over the old methods."

This invention is also applicable to upright mantles. In such a case, however, it is preferred to twist the stocking upon a form provided with a neck—for instance, upon a form described in patent No. 14,798 of 1906—in order that the usual supporting crutch may pass through, and a loop may be provided for suspending the mantle from the crutch.

Automatic Gas Lighter and Extinguisher.

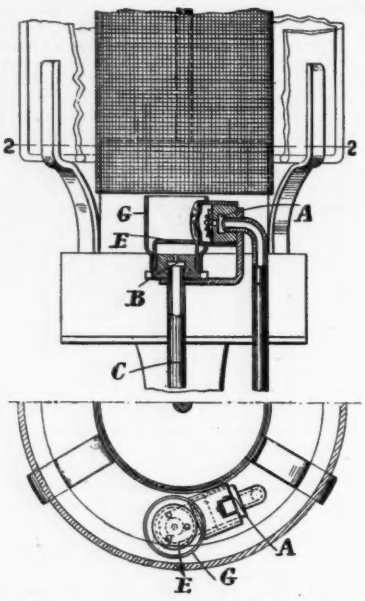
BONNIKSEN, B., and FLETCHER, H., of Leamington.

No. 645; Jan. 11, 1909.

This invention relates to an intermediate burner which "hands on" the flame from the pilot to the main burner and *vice versâ*. The object is "to provide improved screening of the burners to obviate any failure of operation," the actual automatic mechanism employed resembling that described in patent No. 20,348 of 1908.

Preferably, the pilot burner A (p. 244) is supplied as was described in patents No. 4377 of 1906 and No. 12,619 of 1907. The intermediate burner B is supplied by a supplementary valve, which is only opened when the pressure is increased. The supplementary valve (described in the patent of 1908) communicates with a chamber from which a pipe C leads to the intermediate burner. The pilot burner is preferably supplied as usual; but the two pipes leading to the two burners are detachable—being preferably inserted in stuffing-boxes of the usual type, and containing leather or other suitable packing, which may be acted upon by a gland to grip the pipes securely and prevent leakage.

The pilot burner is normally alight when the main burner is extinguished; but when it is desired to light the main flame, which extends over the mantle D to about the level of the line 2, the pressure is increased—operating the mechanism, and closing the supply to the pilot burner while the supply to the main burner is opened. Before the pilot burner is actually extinguished, the increase of pressure has opened the supplementary valve supplying gas to the intermediate burner. The gas issuing from this is ignited by the pilot burner; and as it extends to (say) an inch above the line 2, it ignites the gas of the main burner. The next increase of pressure supplies the intermediate burner



Bonniksen and Fletcher's Automatic Gas Lighter and Extinguisher.

as before, which is lit from the main flame. The main flame is extinguished, and the pilot B is supplied, which takes the light "handed on" to it from the main burner by means of the intermediate flame.

It is desirable that the flame issuing from the burner B be of low velocity—obtained by providing a cap E, which has a suitable number of holes in it, the area of which exceeds the area of the main hole. Further, in automatic mechanism of this type, it is found that "careful and special screening of the pilot and intermediate burners is essential to ensure good results with a small consumption of gas." For this purpose, the burner is provided with a shield G round the burner B, into which screen the burner A projects at right angles to the intermediate burner; the flame from the pilot burner striking the opposite side of the shield.

Incandescent Gas-Mantles.

LEWES, V. B., of Greenwich.

No. 1629; Jan. 22, 1909.

The patentee claims as his invention a method of preventing the shrinkage and buckling of mantles impregnated with a high percentage of alumina and chromic oxide so as to adapt them for use on inverted burners.

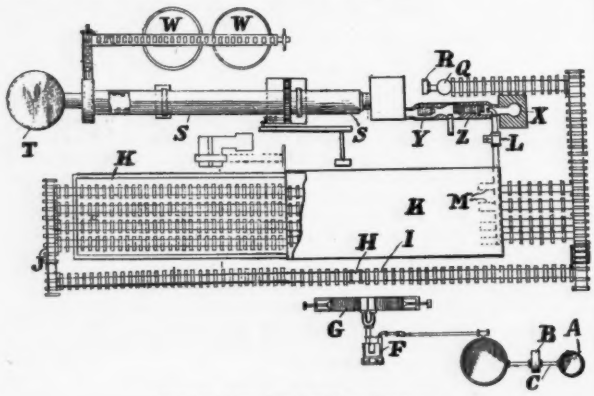
The "JOURNAL" for Nov. 30, p. 597, contained the full text (translated) of the specification filed with the French Patent Office, which is substantially the same as that issued by the English Office last week.

Revivifying Spent Lime.

JONES, J. G., of Carthage, New York State, U.S.A.

No. 6411; March 17, 1909.

This process for revivifying spent lime consists, first, in separating the impurities from the lime in its carbonate state, after which the lime is relieved of a large percentage of its moisture, and, in a plastic state, placed in a drying chamber and subjected to air highly heated by waste carbonic acid gas issuing from a rotary kiln and given up from the waste carbonate of lime being calcined in the kiln.



Jones's Lime Revivifying Process.

A is a separator of impurities from the lime material—preferably by centrifugal action. B is for pumping the lime material, free from its impurities, from the separator into the agitator tank E. A pump F is in communication with the tank E for the purpose of drawing the lime material in a semi-liquid form to a filter-press G, in which the excess of water is filtered off under pressure; the lime being formed into cakes in the recesses between the filter-plates. These cakes are removed from the filter-press, placed upon a car H travelling upon the track I, and conveyed to the track J, which runs at right angles to I, and thence to the kiln K. After the cakes of lime have been thoroughly dried, the cars move on other tracks L leading to the crusher Q, where, after crushing, they are raised by the elevator R into bins and thence to the rotary kiln S. Adjacent to one end of the kiln is a producer T, in which coal is reduced to gas, which is carried into the kiln, where it is burned. The kiln is provided with a brick lining; and certain of the bricks project beyond others for the purpose of agitating the pieces of lime cake as they slowly travel through the rotary kiln, fed by gravity. The gas heats up the fire-brick lining to a high degree, and the crushed lime cake, travelling slowly through the kiln, absorbs the heat from the burning gas and the heated brick lining until it reaches the burning zone, where it gives off its carbonic acid and becomes reduced to the oxide state. The lime is then discharged from the kiln through a hood, underneath which is a conveyor whereby the lime material is carried to an elevator, which conveys it to, and discharges it into, the tanks W.

The patentee says he has found from experimenting that an essential step in this process consists in the granulation of the cakes which have been dried, and passing the granules in a carbonate form through the kiln where the calcining takes place. He has also demonstrated that, where the lime to be dried or calcined is of a loose form when it passes into a kiln, it is not possible to successfully burn it, as it appears to be necessary that the lime when being calcined should be in a dense, solid form. "To secure the best results, the granules should be of such a size as might conveniently pass through a screen of a 1-inch mesh, although granules of slightly larger size can be successfully calcined."

The highly heated carbonic acid gas, which is produced by the calcining of the waste carbonate of lime material, is drawn through the kiln S, thence into a dust-separation chamber; the stack X being utilized to produce a draught whereby the gases are drawn into a water-heater Y, preferably of the standard fuel economizer type. The water contained in the pipes of the heater absorbs a portion of the heat in the carbonic acid, after which the gas is drawn through an air-heater Z, which is composed of a series of air-pipes, through which pure air is either forced or drawn by means of the fan L, and absorbs heat from the gases, and is then discharged into the interior of the drying chamber K through the branching ducts M. The heated gases thus being introduced into the drying chamber come in contact with the cakes in a wet state upon the car, and take up moisture from them.

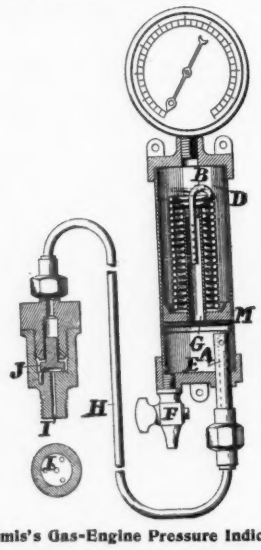
Indicating Explosive Pressures in Gas-Engines.

LOOMIS, O. P., of Newport, Virginia, U.S.A.

No. 10,672; May 5, 1909.

The inventor provides a device by which the pressures at which gas-engines are operating can be conveniently ascertained—information enabling the engineer to tell at once whether proper pressures are being developed in the explosive space of the engine cylinder, and (in the case of multiple cylinders) enabling him to ascertain if all are alike in effort, if any are lacking, and to what extent.

In his prior patent (No. 13,850 of 1908), the inventor described a damping device for pressure gauges which could be used for indicating pressures in explosive engine cylinders; but the present invention has "certain features of improvement."



Loomis's Gas-Engine Pressure Indicator.

The pressure gauge shown is connected to a casing divided by a diaphragm M into two chambers A and D. The lower chamber (termed the sediment-collecting chamber) receives the pressure gases from the engine through a pipe H, having at its end an extension E projecting through the bottom of the chamber. The pipe is closed at top, and has near the top lateral openings which permit the pressure gases to escape into the lower chamber without being thrown outwardly against the layers of wire gauze which extend across the bottom of the diaphragm. There are two layers of copper gauze, the one next to the partition being rather coarse, and the one facing the chamber A being of finer mesh—both layers being held in place by a ring. By this arrangement, gases passing through the finer gauze against the surface of the diaphragm can afterwards pass along its surface to the opening in the pipe G—a large straining area being thus provided, which is not likely to become clogged.

The bottom of the chamber A is provided with an opening normally

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THE BRADDOCK PATENT "SLOT" METER

FITTED WITH

COLSON'S Patent CASH BOX.

A COMPLETE SAFEGUARD AGAINST THEFT.

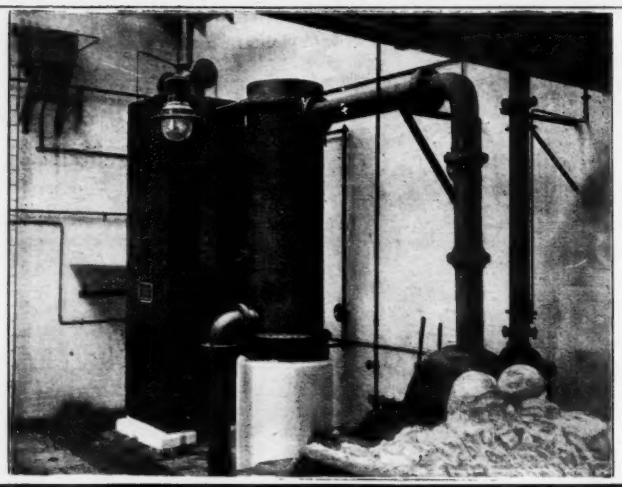
PARTICULARS UPON APPLICATION.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), Globe Meter Works, **OLDHAM,**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE LONDON." Telephone No. 2412 HOP.



W. C. HOLMES & Co.,

LONDON,

And Whitestone Iron Works,

HUDDERSFIELD.

SULPHATE OF AMMONIA PLANT

recently erected at

WALLASEY GAS-WORKS.

NOTICE.

Full Particulars regarding the MERRIFIELD-WESTCOTT-PEARSON Water Gas Plants may be had on application to the Patentees at

19, ABINGDON STREET, WESTMINSTER, S.W.

THE NEW PATENT "COMPACT" ANTI-VIBRATOR

For INVERTED BURNERS.

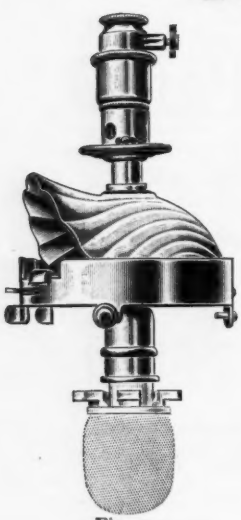
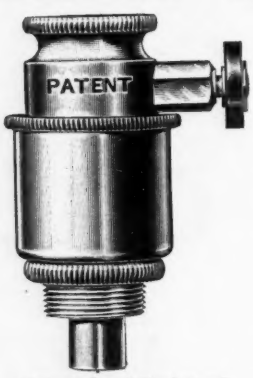


Fig. 1.

Showing the "Compact" Anti-Vibrator fitted to our "SHELL" Burner.

Made to suit any Inverted Burner on the Market.



Patented and Registered.
Actual Size.

The most EFFECTIVE Anti-Vibrator made.

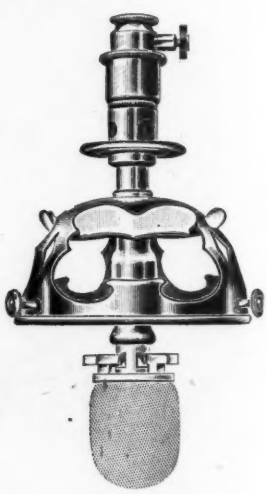


Fig. 2.

Showing the "Compact" Anti-Vibrator fitted to our "LUX" Burner.

No. 12,560. "Compact" Anti-Vibrator, as shown

Price 36s. per dozen.

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closed by a stop-cock F. The soot, carbonized material, &c., carried from the engine cylinder by the gases collect in the chamber A, whence they can be blown out occasionally (along with the water which is always present) by opening the cock. The pressure gases pass from the chamber A upward through the pipe G, and thence into the pipe B, which is coiled so as to provide an extended frictional surface for the gases flowing through it. The combined throttling and cushioning effect produced by the pipe B and the expansion or air-chamber D prevent any violent fluctuations of the gauge needle, and make it practically dead-beat.

The operation of this portion of the device is the same as that disclosed in the prior patent referred to. The gases are admitted from the engine cylinder to the pipe H through a non-return valve J, which is mounted in a valve-casing, the lower part of which is provided with a bore I, opening into a chamber which is, in turn, closed by a plug into which is screwed a coupling which connects the valve-casing with the pipe H. The valve J is, as shown, seated on the bottom of the chamber in such a position as to normally close the bore I. An increase of pressure in the engine cylinder causes the valve to rise and allows the pressure to be transmitted to the tube H.

As the pressures of a gas-engine are pulsating, and at times even non-existent, it becomes necessary, in order to indicate the highest or maximum pressure, to retain the pressure until the highest is reached; and should this maximum decrease, the pressure within the gauge mechanism must be released until it agrees with whatever explosive pressure then exists in the engine cylinder. These results are accomplished by the valve which has just been described.

The small bore I, through which the pressure is transmitted from the explosive space of the engine cylinder through the pipe H, prevents too rapid a rush of gas at first.

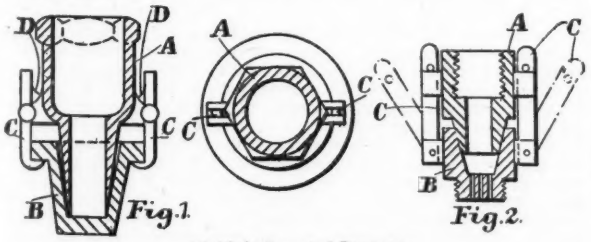
When the engine is started, the valve J lifts and allows the pressure to pass around its stem and enter the space above it, and thence be exerted through the pipe H through the damping mechanism on the gauge. After a few explosions, the pressure on the top of the valve (which keeps the pressure from returning during small intervals) will equal the explosive pressure, and the gauge pointer will cease rising and remain stationary. Should the pressure in the engine cylinder then rise, the valve J will lift and allow it to enter the pipe H until the pressures are again equalized. Should the pressure within the engine cylinder decrease, the pressure within the gauge mechanism is released, because of the fact that the tightness of the valve J is never perfect and slowly allows the pressure to leak back into the explosive space until the pressure in it and in the pipe H again balance. There is thus afforded a continuous dead-beat indication of the maximum pressures existing at any time in the explosive space of the engine cylinder.

Inverted Incandescent Gas-Burners.

STUBBS, H., of Horwich, Lancs.

No. 1809; Jan. 26, 1909.

These inverted incandescent gas-burners are provided with means whereby the nozzle is readily attachable and detachable for the purpose of cleaning.



Stubbs's Inverted Burners.

Fig. 1 shows the supporting levers or arms pivoted to the upper portion of the nozzle. Fig. 2 is a section of a nozzle having the connecting arms pivoted to its lower half.

The nozzle is in two parts A B, having male and female cone connections respectively. C are the attachment levers, shown in fig. 1 as fulcrummed to brackets upon the upper part of the nozzle, and having hooks or catches at their lower ends, which engage with a flange or lugs upon the lower half and serve to hold the two portions in position together. Springs D, interposed between the outer wall of the upper half and the upper ends of the levers, tend to keep the catches at the other ends of the levers in their required positions for holding the two parts of the nozzle together.

In fig. 2, the arms C are pivoted to brackets on the lower half B of the nozzle and catching on to lugs formed on the upper half A.

By this invention, the detachment of the incandescent burner "is rendered an easy operation;" and it also provides "an easy method of cleaning the globes and burner, as by freeing the catching levers the whole of the burner can be taken off and attended to."

The Directors of the Guildford Gaslight and Coke Company have accepted the tender of Messrs. Aldridge and Ranken for a Fiddes-Aldridge stoking machine, coal-handling and electric power plant for their new retort-house, from plans and specifications prepared by their Engineer, Mr. Penrith C. Cleasby.

The Bath Surveying Committee, having considered a report upon complaints as to smells alleged to proceed from the neighbourhood of the Bath destructor works, have agreed that the services of an expert be engaged to ascertain and report (1) as to whether the latest improvements for minimizing smells have been adopted in the case of the destructor, and (2) whether the newest and most effectual methods have been employed by the Bath Gas Company for rendering the fumes from their sulphate of ammonia works as innocuous and inoffensive as possible.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Dessau Vertical Retorts at Sunderland.

SIR,—Referring to the second half of the paragraph in your issue for last week (p. 153), giving the approximate results from our vertical retorts when worked with 12-hour charges (including one hour steaming), the illuminating power of the gas was, through a clerical error, stated as being "about 15½ candles," whereas this result should read "about 16½ candles."

As a matter of fact, the average of the actual results obtained during the past fourteen days is as follows:—

Gas made per ton (corrected)	12,465 cubic feet.
Illuminating power ("Metropolitan" No. 2 burner)	16·84 candles.
Calorific power (net)	559·2 B.Th.U.

Hendon Gas-Works, Sunderland, Jan. 22, 1910. CHAS. DRU DRURY.

The Phenols in Gas Liquor.

SIR,—In the report of the presidential address to the Yorkshire Junior Gas Association in your last issue, I notice a reference to the paper on the above subject which was read before the Manchester Section of the Society of Chemical Industry in December, 1907. The reference is that I had estimated that "half the phenols evolved from the distillation of coal are found in the spent liquor." This statement, which is incorrect, is also given in the "Forty-Fourth Annual Report on Alkali Works," and in the new edition of Lunge's "Coal Tar and Ammonia," and, if not corrected, it might easily prove misleading.

What I did say was that about half the pure phenol (meaning thereby the chemical individual C_6H_5OH) which was produced in the retorts, was lost in the gas liquor. This refers only to the phenol, and has no reference to the creosols and other phenolic bodies which are produced in the retorts.

Manchester, Jan. 21, 1910. F. W. SKIRROW.

Cost of Service-Pipes to Public Lamps.

SIR,—Under the provisions of the Gas-Works Clauses Act, 1871, the undertakers are bound to supply gas to any public lamps within the distance of 50 yards from any of the mains of the undertakers; but there is no provision as to who should bear the cost of the necessary service. I shall be glad to know what the general custom is in this respect, as clause 11, requiring the consumer to pay for the cost of any pipe beyond 30 feet, does not seem to apply.

Jan. 17, 1910. SECRETARY.

Charge Against a Gas-Works Clerk.

On Monday of last week, the charges against George Hepworth, until recently a clerk in the employ of the Pontefract Corporation, at their gas-works (to which reference has already been made in the "JOURNAL"), were investigated at Pontefract. Accused was charged on three counts—with falsifying his books, wilfully neglecting to enter certain receipts, and with embezzlement. He was represented by Mr. Green, and pleaded "Not guilty." Mr. Woodhead, who prosecuted for the Town Clerk, stated that apparently prisoner had entered in his books the correct amounts as paid in by the collectors, but subsequently altered the cash figures, and adjusted the records of consumption to balance. Mr. L. V. Whitaker, the Gas Manager, said accused's wages were 30s. per week. When told that the Auditors wished to see him at the municipal offices because there were two or three errors in the casting of his columns, he observed, "Oh, dash it!" and when witness subsequently returned to the office he had disappeared. Witness was cross-examined at some length, but refused to admit that the affairs of his department were in a muddled condition. The Bench committed Hepworth to the Borough Quarter Sessions for trial, allowing bail.

Obtaining a Gas Supply under a False Name.

At the Birmingham Police Court, on Friday, George Howard Smith was summoned for having obtained a supply of gas from the Corporation under a name other than his own. Mr. Prideaux, who prosecuted, called evidence to show that, in December, Inspector Edwards, of the Gas Department, called at No. 21, Hallam Street, in the course of his rounds, and found the defendant in occupation of the house, which had previously been void. He adjusted the slot-meter, where there was a shortage of 2s. 5d., and received from defendant an order for a gas supply signed "Frederick Whitehouse." The defendant admitted having given a false name, but said a man named Whitehouse had promised to lodge at his house and to be responsible for the rent and gas. Mr. Prideaux informed the Bench that this was by no means an isolated case. Since September, 1908, it had been the defendant's practice to move from house to house, consuming gas through slot-meters, and when found in occupation giving a false name. He had lived at five addresses during the period named; and on eight occasions when the state of the meter was taken, shortages were found. On Jan. 14, having been traced by Detective-Sergeant Harris, the defendant confessed to having appropriated these sums by means of a false key. A fine of 40s. and costs was imposed, with the alternative of fourteen days' imprisonment.

Besançon Gas-Works Flooded.—Owing to the large quantity of rain which has lately fallen, France has been visited by floods which have done serious damage. At Besançon the gas-works are 3 feet under water, and several bridges are reported to have been destroyed. The whole department of the Yonne is said to be flooded; and in the valley of the Rhône there has been loss of life. The lighting service has been interrupted in a number of towns, and work has had to be suspended in many factories.

MISCELLANEOUS NEWS.

BIRMINGHAM CORPORATION GAS DEPARTMENT.

The Vacancy Caused by the Death of Mr. G. Hampton Barber.

In their report to be presented at the quarterly meeting of the City Council on the 1st prox., the Birmingham Gas Committee say: "Your Committee deeply regret to report that Mr. G. Hampton Barber, Secretary and Manager of the undertaking, died on Dec. 2 last, after a few days' illness. Mr. Barber, who was appointed in February, 1901, was a most capable and valuable officer, and devoted himself with much energy to the work of the department. He served your Committee with unswerving loyalty and enthusiasm, and displayed exceptional commercial ability in the performance of his duties. The Committee recommend that they be authorized to fill the vacancy, and to offer such salary as they may consider reasonable."

The report also contains the following comparative statements for the quarters ended June 30 and Sept. 30, 1908 and 1909.

Quarter ended June 30.	1908.	1909.	Increase.	Decrease.
Sale of gas—cubic feet	1,406,791,700	1,420,914,700	14,123,000 = 1 p.c.	—
New services. . . .	1,648	1,963	315	—
Total number of prepayment meters fixed at June 30	57,522	64,189	6,667	—
Total number of cooking-stoves fixed with prepayment meters at June 30	42,921	50,679	7,758	—

Quarter ended Sept. 30.	1908.	1909.	Increase.	Decrease.
Sale of gas—cubic feet	1,290,196,500	1,351,437,400	61,240,900 = 4·7 p.c.	—
New services. . . .	1,953	1,936	—	17
Total number of prepayment meters fixed at Sept. 30. . . .	58,979	65,674	6,695	—
Total number of cooking-stoves fixed with prepayment meters at Sept. 30	44,720	52,554	7,834	—

The reconstruction of No. 2 retort-house at the Adderley Street works has now been completed; and as a result of carbonizing in the new house, the cost of manufacture at the station has been considerably reduced. The Committee have authorized the laying of a new 36-inch main between the Saltley and the Nechells works, and the alteration of certain of the existing mains, for the purpose of better mixing the gas produced at the works named. The new arrangement will also facilitate and improve the distribution from both stations. The work has been commenced; but it cannot be completed until the spring.

LITTLE HULTON DISTRICT COUNCIL'S GAS SCHEME.

Rejection by the Ratepayers—Question of a Poll under Consideration.

The Statutory Meeting last Wednesday evening of the ratepayers of Little Hulton was held to consider the scheme of the Urban District Council to apply for parliamentary powers to purchase the gas-mains in their area belonging to the Salford Corporation and the Farnworth and Kearsley Gas Company, and make the necessary arrangements for furnishing a supply of gas for public and private purposes.

Mr. W. Hodgkiss, J.P., the Chairman of the District Council, in moving a resolution approving of the promotion of the Bill of which notice had been given, said it had only been possible to enter into the proposed undertaking by coming to an amicable agreement with the Salford Corporation, who were selling their mains at a lower price than Mr. Newbigging, the Council's adviser, had said they might have to pay for them. Subject to the passing of the Bill, the Council had agreed to buy from the Earl of Ellesmere gas in bulk at 9d. per 1000 cubic feet; and the price might be reduced under certain circumstances, but was never to be increased. If the gas was to be enriched, they would have to pay ½d. per candle power more. The present idea was to light the whole of the streets by means of incandescent mantles, which, with gas from the Brackley plant of Lord Ellesmere, would save them about £100 per annum.

The resolution having been seconded,

Mr. Hodgkiss, in answer to questions, said the Council were pledged not to make known the amount to be paid to Salford; but he assured the ratepayers an excellent bargain had been made on their behalf.

A Ratepayer said the price had been given as £7500; and he asked if that was correct.

Mr. Hodgkiss agreed that this was the figure.

The Ratepayer went on to say that the public should know that, in addition to the £7500, a sum of £2500 would be required to purchase the Farnworth undertaking, that £2000 was to be borrowed for new mains, another £1000 for working expenses, and perhaps £500 to get the scheme through—making a total of £13,500. If all this came out of the rates, he wanted to know what the increase would be.

Mr. Atkinson, a member of the Council, stated that the bargain they had made would enable the Council to reduce the price of gas 3d. per 1000 cubic feet, and probably 5d. in the future. If Worsley and Swinton, and probably Westhoughton, joined in the scheme, they would be in a still better position. They had also to remember that if the price of coal went up, as it was sure to do, their gas would remain at the same figure.

At this point, Mr. Newbigging, at the request of the Chairman, addressed the meeting. He said the price to be paid to the Salford Corporation was very favourable to the Little Hulton community. Whatever shortcomings Salford had been guilty of in the past with regard to the gas supply, they had in this matter been most fair and reasonable. The ratepayers should not forget that they were taking over a going concern, and would have immediate revenue sufficient to cover their payment of interest and also the sinking fund.

On being put to the vote, the resolution was declared to be lost.

In view of this decision, the Council will, at their meeting next month, consider the question of taking a poll of the ratepayers on the question.

GAS SUPPLY CONDITIONS IN BUENOS AYRES.

The New Contract with the Municipality.

Our readers are aware that, as from the 1st inst., the conditions of gas supply in Buenos Ayres are somewhat different from those previously existing, owing to the amalgamation of the Buenos Ayres (New), the River Plate, and the Primitiva Gas Companies. It may be of interest, before the matter passes into history, to indicate the chief features of the new contract entered into between the Municipality and the last-named Company, who are now solely responsible for keeping up the supply of gas.

The contract sets forth at the outset that the Company are authorized, for a period of twenty years, to produce, distribute, and sell gas within the municipal jurisdiction of the Federal capital, whether for lighting or for domestic or any other industrial purpose. The maximum price to be charged for gas employed for private lighting is 21c. paper currency per cubic metre, which is equal to 10s. 4d. per 1000 cubic feet; for public lighting, public establishments, institutions, &c., 15c. per cubic metre, or 7s. 4d. per 1000 cubic feet; and for cooking and other purposes, apart from lighting, 16c. per cubic metre, or 7s. 10d. per 1000 cubic feet. These prices are, however, subject to reductions in the case of large supplies. Provision is made for the reduction of the price by 0·5c. per cubic metre for every 7½ million cubic metres, or a fraction thereof, beyond a specified quantity, to come into force in the year following that in which the excess of sales may have taken place. When these reductions reach more than 25 per cent. of the maximum charges already mentioned, they are to cease, except as hereafter specified. The Company are to adopt any new invention or system for making gas which may allow of a saving to the extent of 20 per cent. in cost of production; and when this takes place, the maximum charges are to be reduced to the extent of half the economy effected. The Company are also to adopt any method which, in their opinion, or in that of the Municipality, will permit of the reduction of the quantity of carbon monoxide in the gas, or will in any other way improve its quality.

The Municipality are to have the right to examine the books and statistics of the Company, in order to ascertain whether or not the terms of the contract are being complied with. In the first quarter of each year, the Company are to present to the Municipality a complete balance-sheet, accompanied by details of their operations in the preceding twelve months; and also to furnish any information the Municipality may require. They are to put up station meters to register the quantity of gas made and supplied; and also provide the necessary apparatus for testing the illuminating and calorific power, purity, and pressure of the gas, and fit it up in their works and branch offices, as well as in the offices of the Public Lighting Department of the Municipality. They are to pay quarterly to the Municipality 10 per cent. of the gross receipts from the sale of gas within the municipal boundary, or any extensions of it. The gas sold for public lighting is exempted from this tax. An allowance of 12 per cent. is made for leakage in the portion of the gas production registered in the works and affected by the tax. The Company are also to pay the necessary rates for local services in respect of their property, including street sweeping, cleaning, and lighting; also for the municipal inspection of their machines, new buildings, and all other taxes which any other company or society would have to bear. They have likewise to pay the tax for testing their meters by the Municipality, and for testing the burners for use in public lighting, in accordance with the existing tariff.

The concession granted is subject to the regulations subjoined to the contract for guaranteeing the good quality and sufficient pressure of the gas supplied, as also the public safety, and likewise to the penalties specified therein and in any ordinances which may in the future be promulgated with the same objects in view. The existing ordinances with reference to the consumption and illuminating power of burners used for public lighting are to remain in force in case the Municipality should resolve to adopt any other types of burners; and the Company are to be obliged to supply these at cost price. They are also to remove or change the position of lamps and columns within such reasonable time as may be fixed by the Municipality, without any extra payment therefor.

When the Company require to interfere with a public roadway, they have to submit to the Municipality a drawing with details of the condition of the subsoil with respect to any mains, cables, &c., existing; and the officials of the Municipality who are charged with the inspection and care of the electrical installations and of the public lighting are to facilitate this by furnishing all the particulars they may have at their command. Permission to lay mains is not to be refused by the Municipality except for a just reason—such, for example, as when the work would, in the opinion of the officials, be dangerous to the public. The Company have, however, the right of appeal to the Council.

The Company must not refuse a supply of gas to any consumer who requires it, where they have mains laid. The supply of gas cannot be withheld except in the case of the monthly account remaining unpaid

after the expiration of the first fifteen days of the following month. The gas may be cut off when a consumer makes an illicit connection with the main or tampers with the meter with the view of defrauding the Company; and it is to remain off until he has paid his account, as settled by the officials of the Municipal Lighting Office.

Any difference arising on the contract is to be determined by arbitration, the conditions of which are set forth. The Municipality will insist upon exact compliance with the terms of the contract; and they have the power also to name a special representative for the purpose. Infraction of the stipulations contained in the contract is punishable by a fine of $1000 paper currency for the first offence, and of $2000 for a succeeding one. The fines are to be imposed as often as infractions occur; and as a guarantee for them, the Company are to keep in the National Bank, to the order of the Municipality, the sum of $10,000.

Incorporated in the contract are the regulations already referred to. It is specified that the gas supplied by the Company is to be produced by the dry distillation of bituminous coal, and that it may contain an admixture of either pure or carburetted water gas to an extent limiting the carbon monoxide to 17 per cent. by volume, unless unavoidable circumstances necessitate an increase. It is to be perfectly free from sulphuretted hydrogen; and the maximum quantity of ammonia allowable is 17·48 grains per 100 cubic feet, and of sulphur compounds 30·59 grains in winter and 21·85 grains in summer. The minimum pressure is to be 1¾ inches of water in the high portions of the city; and the presence of naphthalene in the service-pipes is not to justify failure to maintain the pressure named. The illuminating power of the gas is to be not less than 14½ English candles, tested with the "Metropolitan" No. 2 argand burner, adjusted to a consumption of 5 cubic feet per hour; the unit of comparison to be a 2-candle Methven lamp. The calorific power is to be at least 539·2 B.Th.U. net per cubic foot, as tested by the Simmance-Abady calorimeter. The test for sulphuretted hydrogen is to be made as usual by means of acetate of lead paper; that for ammonia, by means of standard solutions of sulphuric acid; and that for pressure, by gauges in the Municipal Offices and elsewhere. Failure to comply with the regulations in respect of the before-mentioned matters will subject the Company to the following daily penalties. For the presence of sulphuretted hydrogen in the gas, $200; for each 2½ grains excess of ammonia per 100 cubic feet, $20; for each 4½ grains excess of sulphur compounds in a like quantity of gas, $20; for each 1 per cent. in excess of carbon monoxide, $100 for every case; for each 1-12th inch of pressure below 1¾ inches, $20; for each 5·5 B.Th.U. less than 539·2 B.Th.U. per cubic foot, $30; for each failure to maintain the standard of illuminating power, $20. The English equivalents of these fines may be readily ascertained by reckoning $11¾ paper currency as £1 sterling.

KIRKCALDY GAS TRANSFER QUESTION.

A Special Meeting of the Kirkcaldy Town Council was held on Monday evening of last week, in connection with the gas transfer under the provisions of the Burghs Gas Supply (Scotland) Act, which has been approved by the ratepayers.

The Town Clerk (Mr. W. L. Macindoe) reported the result of the vote which was taken on the 12th inst., and intimated that the resolution adopting the Act was registered in the Sheriff Court books on the 14th inst. Mr. J. Wright moved, Mr. J. Alison seconded, and it was unanimously agreed, that the Town Clerk should serve notice on the Kirkcaldy Gaslight Company, Limited: "I hereby give you notice that the Provost, Magistrates, and Councillors of the Burgh of Kirkcaldy have passed a resolution, which has been duly confirmed—'That the Burghs Gas Supply (Scotland) Act, 1876, be adopted and applied to the burgh,' which resolution was registered in the Sheriff Court books of the County of Fife on Jan. 14, 1910, and the provisions of the said Act are now in force. And I further give you notice, in pursuance of the provisions contained in the said Act, that the Town Council are willing to buy or to treat for the purchase of the undertaking of the Kirkcaldy Gaslight Company, Limited, and of all the rights, powers, and privileges, and all the lands, premises, works, and other property of the Company."

It was agreed to remit to the Gas Committee (with powers) to employ an expert to examine and report on the Company's works and property, and to instruct Mr. R. Cockburn Millar, C.A., of Edinburgh, to examine and report on the Company's books.

A vote of thanks was unanimously accorded to the Town Clerk, and to Mr. Barr, his Depute, for their careful and accurate work in connection with the important subject of the transfer.

Cost of the Bermondsey Explosion.—The General Purposes Committee of the Bermondsey Borough Council report the receipt of a letter from Messrs. Hicklin, Washington, and Pasmore, solicitors, acting on behalf of the London County Council, the Metropolitan Water Board, and the South Metropolitan Gas Company, asking for a statement of the Council's claim against the authorities named in respect of the damage done by the explosion in Grange Road on Dec. 30, 1908. The Committee forwarded a claim for £4455 5s. 8d. This sum includes the net expenditure by the Borough Council, £100 in respect of the legal work done by the Town Clerk, and interest on the £5000 borrowed by the Council to repair the damage.

Street Lighting in Westminster.—The Works Committee of the Westminster City Council report having considered what steps should be taken, in view of the termination, on March 31 next, of the contracts with the Gaslight and Coke Company for low-pressure gas lighting. The matter is important; and in case the Council may not have concluded arrangements for a new contract or contracts commencing on the 1st of April, it is advisable to arrange for the existing contracts to be continued, if necessary from month to month, on the present terms. This is to be done, subject to the concurrence of the Company. In reply to a petition signed by 59 residents and traders in Victoria Street, calling attention to the inefficient lighting of that thoroughfare, the petitioners are to be informed that an experimental installation has been arranged.

COST OF GAS AND ELECTRIC LIGHTING.

In the Engineering Supplement to "The Times" for the 12th inst., there was an article on "Concentric Wiring and Metal Filament Lamps," from an electrical correspondent, in the course of which it was stated that "metal filament lamps, if properly installed, provide a cheaper and healthier light than gas-mantles." The statement was promptly replied to by Mr. Hanbury Thomas, the Managing-Director of the Sheffield United Gas Company, in the following letter, which was inserted in last Wednesday's "Supplement."

This, to say the least of it, is a very erroneous assertion for any electrician to make, unless he added that the comparison was with gas at at least 5s. per 1000 cubic feet—a price which is only charged in villages. The circular I send herewith shows the comparative cost of gas and electric lighting in Sheffield; and by it you will see that with the metal filament lamp electric light is four times as dear as gas with the incandescent mantle. Mr. F. H. R. Lavender, in a paper which he recently read before the Birmingham local section of the Institution of Electrical Engineers, gave a table showing the results of tests of six metal filament lamps with an initial candle power varying from 21·5 to 31·2, wherein he showed the maximum cost per 1000 candle-hours to be 8·8d. and the minimum 5·6d., with electric current at 4d. per unit, whereas the cost of 1000 candle-hours for an incandescent gas-burner is rather under 1d., which more than bears out the figures shown in the enclosed circular.

With regard to the hygienic aspect of the two forms of illumination, the researches of Dr. Rideal, Mr. Hebner, and others, have abundantly proved that gas has nothing to fear from comparison with electricity. Although some amount of carbonic acid is produced by the combustion of gas, the air of a room is not necessarily contaminated thereby, as the heat from the burning gas assists the natural ventilation, and promotes the egress of foul air and the ingress of fresh air. Moreover, the idea that carbonic acid is itself poisonous has long ago been exploded. It is the poisonous products of respiration that are associated with it, when evolved from human beings, which make the atmosphere of a crowded room impure. Whereas one can breathe with impunity an atmosphere containing 100 parts of carbonic acid per 10,000 parts of air, one of 10 parts per 10,000 due to the respiration of human beings would be highly dangerous.

It is a pity that electricians should make these very misleading statements; and I do not think that this pays in the long run, as in many cases, not only in Sheffield, but in other parts of the country where gas is dearer than here, the electric light is replaced by gas on the ground of expense.

The circular referred to by Mr. Thomas stated that with current at 4d. a unit the cost per hour of a 16-candle carbon lamp using 60 watts is ¼d.; of a 32-candle osram or other metallic filament lamp using 40 watts, 1-6th of a penny; and of a 50-candle osram or other lamp using 62 watts, ½d.; whereas a 60-candle incandescent gas-burner using 4 cubic feet of gas at 1s. 4d. per 1000 costs 1-16th of a penny per hour, and a 60-candle inverted incandescent gas-burner using 3½ cubic feet at the same price, 1-18th of a penny.

THE FATAL GAS EXPLOSION IN THE CITY.

At the City Coroner's Court last Wednesday, Dr. Waldo held an inquest on James Thomas Lloyd, a painter and decorator, who was found dead as the result of a gas explosion at the offices of Messrs. Jackson, Pixley, and Co., accountants, in Coleman Street on the 15th inst., as reported in the "JOURNAL" last week (p. 195). Helen Green, a cleaner at the premises, said that when she arrived there about five o'clock in the morning on the day in question there was a smell of gas. She went down to the basement without a light and opened the windows, and afterwards she opened every window on the six floors. Deceased arrived about eight o'clock, and she asked him if he smelt gas. He replied that he did, and said there must be an escape somewhere. As he was going downstairs for his paints, witness said: "I have not had a light this morning; don't you light up." Lloyd was not smoking, and had no light with him. There was a gas apparatus in the basement; but deceased had not made use of it. Five minutes later, witness was taking letters from the postman at the door when there was a loud explosion. The marble step on which she was standing parted, and she was thrown into the middle of the road. In reply to a Juror, witness said she was the last to leave the premises on the previous evening, and everything then was all right. The gas was not turned off at the meter, which was in the basement. Archibald Thomas Nash, an officer at the Redcross Street Fire Station, said a call was received at 8.23 a.m. on the 15th inst., and he with some men were on the scene in a minute-and-a-half. Entering the basement, they found the deceased at the foot of the stairs, having upon him heavy masonry which appeared to be part of the strong-room. There was a very powerful odour of coal gas. There was a ventilation aperture close to the strong-room floor, through which there was a gas-pipe. There must have been an escape of gas into the strong-room, and a slight explosion outside which connected with the larger quantity of gas inside the room, which had been full of gas, because the explosion blew out 14-inch walls. A light must have been introduced into the basement somehow. George Rains, a clerk, deposed that a gas-drier was put in the strong-room on account of dampness. It was lighted in the morning, and put out about four o'clock in the afternoon. Mr. S. J. Hood, an Assistant Inspector in the service of the Gaslight and Coke Company, stated that if the deceased used a light, and the explosive mixture was in the strong-room, the draught from the open windows would have caused the mixture to explode. The force of the explosion would have been away from the deceased, and he would not have been burnt. Witness did not think a light from the outside caused the explosion. A police-sergeant stated that no matches were found on the body. Dr. Kearney, the Police

Divisional Surgeon, described the injuries sustained by deceased, and said that death was due to shock. There were no marks of singeing; and he would have expected that if the deceased had caused the ignition such marks would have been observed. The Jury returned a verdict of "Accidental death, due to an explosion of coal gas, the cause of which was unknown."

INCREASED STORAGE AT HECKMONDWIKE GAS-WORKS.

Presentation to the Chairman of the Company.

A new gasholder of upwards of a million cubic feet capacity, recently erected on the works of the Heckmondwike and Liversedge Gas Company by Messrs. Clayton, Son, and Co., Limited, of Leeds, has just been brought into use. It is of three lifts, in a steel tank; and it was designed by, and erected under the superintendence of, Mr. F. D. Richmond, the Company's Engineer and Manager. The turning of the gas into the holder was performed by the Chairman, Mr. J. J. Stead, in the presence of the Directors, the Contractors, and the Manager. After a few brief remarks, the party adjourned to the Board-Room, where toasts to the success of the Company, the Chairman, the Contractors, and the Engineer were proposed and duly honoured.

A brief history of the Company was given by the Chairman, who stated that the Company was established in 1843 with a capital of £750. New works were built on the present site in 1850; and in 1862 the Company was incorporated. Further powers were obtained in 1875; and last year an Act was passed for sanctioning increased capital and extensions of the works. It was opposed by the Urban District Councils of Heckmondwike and Liversedge, who succeeded in getting inserted a suspensory clause, giving them the power to promote a Bill the following session. But when the resolution for compulsory purchase was submitted to a meeting of the ratepayers of the two townships, it was negatived by an overwhelming majority; and so the undertakers were left to carry on their work as a Company. The Chairman stated, as a coincidence, that the gasholder just inaugurated was the sixth in the history of the Company (three being now in use), that he was the sixth Chairman, and that he was in his sixth year of office.

A pleasant incident of the proceedings was the presentation to Mr. Stead of a beautiful solid silver cigar-case, with the following inscription and a design of the new holder engraved upon it: "Presented to John James Stead, Esq., Chairman of the Heckmondwike and Liversedge Gas Company, by Frank Dean Richmond, Engineer, Manager, and Secretary of the Company, on the occasion of his opening the valve to the new one million cubic feet gasholder. January 14, 1910."

"DOMESTIC" WATER SUPPLY AND MOTOR-CARS.

Bradford Corporation Bill

Some 300 or 400 ratepayers put in an appearance at the statutory public meeting held last Tuesday for the purpose of considering the proposed Bill of the Bradford Corporation. The Lord Mayor (Alderman W. Land) presided; and, in response to the request of those present, the clauses were put separately to the meeting.

Mr. A. E. Masser said he appeared on behalf of the Bradford Automobile Club to object to the inclusion of a clause defining the meaning of the term "domestic purposes" in connection with the supply of water. The clause read: "A supply of water for use elsewhere than in or in connection with a dwelling-house shall not be deemed to be a supply of water for domestic purposes." He first called attention to a discrepancy between the references to this clause in two advertisements of the Bill, and argued that unless the alteration made in the clause had received the assent of two-thirds of the City Council the whole proceedings of that meeting were invalidated.

The Lord Mayor replied that the clause which appeared in the copy of the Bill deposited in Parliament had received the assent of two-thirds of the City Council.

Mr. Masser went on to say that the clause was an attempt to override by a Private Act of Parliament a legal decision as to the nature of a domestic water supply. The Bradford Automobile Club had challenged the Corporation to take out a summons in the Police Court in order to test the legality of making a special charge for water used for washing a motor-car; and this challenge had been declined, because the Corporation knew that they were bound hand and foot by the decision in *Harrogate Corporation v. Mackey*. The proposed charge of 1s. per horse power per year was the height of absurdity; and unless the Automobile Club received assurances of reasonable treatment, they would oppose the Bill through all its stages.

Mr. G. H. Kent described the charge as unfair, and warned the ratepayers that if the Corporation were successful in securing this definition of a domestic supply, they would use it against others besides the owners of motor-cars.

Alderman Lupton remarked that he could assure the Automobile Club that the Water Committee would be equitable in the exercise of their powers.

Mr. Masser said he was very pleased to hear this expression of opinion from a member of the Council. It was the absurd method of the proposed charge to which automobilists objected. The owner of a four-seated 10-H.P. car with a tremendous surface to be washed would only have to pay 10s., while for a 60-H.P. two-seater, he would have to pay 60s.

Mr. James Crawshaw objected to the inclusion of the clause unless at the same time there was included a definite scale of charges for domestic and all other purposes.

Mr. S. Dixon asked if the clause would give the Corporation the right to charge for the swilling of a back yard.

The Lord Mayor: It does not apply to that.

Mr. Dixon: Then if you can swill your back yard, why can't you swill your dog, or your horse, or your carriage?

The clause was carried.

WATER SUPPLY IN A RURAL DISTRICT.

At a District Meeting of the Institution of Municipal Engineers, held at Gloucester on the 7th inst., a paper was presented by Mr. William Whitehouse, entitled "A Record of Twenty-Five Years' Experience in a Rural District." The object of the author was to set forth some of the conditions under which an engineer and surveyor has to work in a rural district, and the difficulties to be overcome in meeting the increased demand for water, drainage requirements, hospital accommodation, and new roads, during a period of twenty-five years.

The district with which he is associated is situated in the county of Gloucestershire, and consists of eleven agricultural parishes and the township of East Dean. The township of East Dean is in the Royal Forest of Dean, and is the portion in which most of his work lies. The area of the district is 28,646 acres, the population about 20,000, and the number of inhabited houses about 4500. Most of his work lies in the township of East Dean, as this part of the district has systems of water supply and drainage, and, in fact, one portion—Cinderford, and its environs—is quite urban in character, and has a population of about 8000. The East Dean portion of the district is in a very scattered condition; and this renders the control of sanitary matters expensive and difficult. Long stretches of mains have to be constructed, both for water and drainage purposes, to accommodate a small number of houses. The portion of the paper dealing with the water undertaking was in terms of which the following is an abstract.

It was necessary, in consequence of the Forest being a mining district, to obtain a supply from some part where it would not be likely that mining operations would interfere. Fortunately, this was not difficult. In fact, the discovery had already been made, and the supply was available. Messrs. Henry Crawshay and Co., who were owners of both iron ore and coal gales, drove a heading at a place called Greenbottom, with the idea of draining the percolating surface water from the limestone crop, and so prevent it getting into their iron ore measures. This heading was started in the old red sandstone, and driven through to a bed of shale—which is about 40 yards thick, and lies between the sandstone and limestone—and then through the limestone to a shaft called the Beech Pit. This heading is about 400 yards long; and from what can be gathered from the information handed down by the workmen, considerable trouble was experienced in performing the work. When about 100 yards of the heading had been driven, or almost through the sandstone, the workmen had to cut through, for a considerable distance, a bed of conglomerate, or what is locally known as the pudding stone rock. This rock yielded water so rapidly that the driving had to be abandoned for a time. The work was, however, subsequently again taken in hand and completed. This supply, being outside the coal and iron ore measures, was absolutely reliable; and it is not surprising to find that the rural sanitary authority turned their attention to it when searching for a source of supply. Negotiations were entered into with the Crown, the right to the water secured, and the works started, I believe, about the year 1870.

The works consisted of a pumping-station and service reservoir, from which the water gravitated to the consumers. A small pump-well was constructed near the mouth of the heading, from which the engines raised the water to the service reservoir. The engines are high pressure, and of the horizontal type, nominally 20 H.P. each, and manufactured and fixed by the old firm of James Watts and Co., Soho, Birmingham. Each engine is capable of raising 8000 gallons per hour. It is hardly necessary to state that in these days of gas, oil, suction gas, electrical power, &c., plant of the description mentioned would hardly be considered. However, the engines are well made, have done excellent service, and are to-day in first-class condition. The engines have to raise the water to the service reservoir, which is about ¾ mile distant, and a vertical height of 406 feet above the pumping-station. The load upon the engines is heavy; and at first considerable difficulty was experienced with the pump-valves. However, improvement has been made in them; and they are now working exceedingly well.

The service reservoir is round in shape, 61 feet diameter at bottom, and 62 feet at top. It was, until enlarged, 10 feet deep to the water-line, and therefore of 185,000 gallons capacity. Originally the reservoir was not covered. The rising main from the pumping-station is 6 inches in diameter; and the service mains from the reservoir vary from 5 to 3 inches. The district is a very hilly and undulating one; and great difficulty has always been experienced in supplying the high-level districts—due, no doubt, to the fact that the trunk mains have been throttled, friction, and the large draught made upon the mains in the low-lying parts of the district. The length of the mains originally constructed would be about 10 miles; and the pressure in the lowest parts of the district is about 175 lbs. When I first became acquainted with the works, some 27 years ago, the number of houses connected with the mains was about 200, and the population supplied 1000.

In the year 1884, it was found to be necessary to do something to meet the increasing demand for water; and at this time the difficulty was overcome by the construction of an impounding reservoir near the pumping-station, to store the water which flowed from the heading during the night, and at times during which pumping was not being performed. This impounding reservoir is 270 feet long by 15 feet wide, and 9 feet deep, with a capacity of 225,000 gallons. The impounding reservoir was connected with the pump-well; and the water from the heading continually flows into it, and through an overflow to the waste drain when full, though means of diverting the water through the pump-well were made, in case of emergency, or to enable repairs to be made to the reservoir. The impounding reservoir is constructed of 9-inch brickwork, with internal counterforts and concrete bottom; and it was covered with a galvanized iron roof. Considerable difficulty was experienced in making the reservoir water-tight; but it was eventually rendered so by cement concrete and blue brick underpinning, and outside counterforts. The chief cause of the trouble was, I believe, in consequence of a portion of the reservoir having been built over an old watercourse, and on sideland ground, which necessitated supporting the one side with a new bank, which gradually set.

The Rural District Council was formed in 1894; and I was appointed Surveyor in 1896. For several years, the yield of water at our heading had not been sufficient to maintain a constant supply during portions

of the year; and after my appointment, I immediately turned attention to this problem. As previously stated, our service reservoir was not covered; and in consequence of its being open to the sun and light, algæ, or water weed, was very rapidly formed in hot weather, with the result that it was necessary to cleanse the reservoir about every twenty-one days, and I have known it to be necessary to do so in fourteen days. On one or two exceptional occasions, when scarcity or bad weather has prevented the work of cleansing being performed, I have seen large quantities of insects mixed with the water weed—in fact, a living mass. It must not be assumed from this that our water supply is an impure one—derived, as it is, from a source upwards of 120 feet below the surface. An analysis of the water made by Mr. Embrey, the County Analyst, showed it to be very pure, and well fitted for domestic use.

After receiving the Council's permission to prepare a scheme for covering the reservoir, I had first of all to consider the question of maintaining the supply to the consumers during the performance of the work. This was got over by tapping the rising main, fixing valves, and constructing a branch round the reservoir from the rising main to the service main, so that the water could be pumped into the service main direct. The fluctuations of the consumption were met with a 200-gallon storage tank, and the excess passed through an overflow-pipe into the waste drain. After a few days, we were able to gauge the rate of supply so nicely during the day that very little waste occurred. The supply of the district was maintained some months in this manner.

After a good deal of careful consideration, I made up my mind that the best, cheapest, and most durable, as well as the least expensive to maintain, was a ferro-concrete covering. Though I say ferro-concrete, it could hardly be considered the highly scientific method now so popular with engineers. It was simply an adaptation of the system of fire-proof floor construction. The reservoir being round, made it rather awkward to cover; but the plan adopted simplified the work very much. The main joists are 12 in. by 6 in. steel, the ends resting on the wall, and the bearing supported by pillars built with Staffordshire blue bricks set in cement. The lateral joists are 6 in. by 3 in. steel. Staging was fixed to the underside of the lateral joists; and the latter were afterwards cased in cement concrete of the following specification: Aggregate 4 parts washed clinker and 1 part washed sand. Matrix 1 part portland cement. This gave a very satisfactory result.

It was also decided to increase the size of the reservoir; and it was therefore made 5 feet deeper, and the 18-inch stone wall carried up 3 feet to form a parapet and to support the ends of the joists, and so stiffen and strengthen the floor. The reservoir was provided with inlet and outlet cast-iron ventilators. The deepening of the reservoir gave us 50 per cent. more storage room; and during the next twelve months, it also gave us considerable trouble.

Previous to taking this work in hand, I had consulted some old plans; and from them it appeared that the reservoir walls and floor were built on a good concrete foundation, which I calculated would easily bear the extra weight we placed upon it. However, three months after the work had been completed, there was considerable and continuous leakage. I took up part of the floor for examination, and found that the stone-slab paving was laid on clay puddle, and not on concrete as shown by the old plans. I lifted the greater part of the floor, and laid a foot of cement concrete underneath it, as well as doing as much underpinning as I could with safety. This caused considerable improvement; but still the leakage continued, and was more pronounced when the reservoir was full. I then came to the conclusion that the walls expanded with the weight of the water; and I had eight concrete counterforts constructed on the outside of the well, each counterfort being 17 ft. by 6 ft. by 4 ft. 6 in., and built up from the bottom of the foundation. These means effectually cured the trouble; and there has been no evidence of leakage since.

The covering of the reservoir proved to be a complete cure of the water-weed trouble; and though we cleanse the reservoir once a year, there is never a vestige of algæ, and, with the exception of a little sand which is pumped up from the intake, the water appears as clear and satisfactory at the end of twelve months as at the commencement. I estimate that we saved about 700,000 gallons of water yearly by covering the reservoir, as we had to send about 50,000 gallons through the waste-pipe every time the reservoir was cleansed. We also saved the cost and trouble of cleansing, as well as the annoyance and inconvenience to consumers by stopping the supply. But, of course, the greatest benefit of all was the improved quality of the water.

Although covering our service reservoir meant a great improvement in the quality as well as in the quantity of water, we were still unable to maintain a constant supply during periods of drought. I therefore tried the introduction of a superior class of fittings and machinery for tapping the mains under pressure, and employed an inspector, who gave his whole time to the repair of leaky taps. All these things reduced the consumption; but, as the number of consumers increased, the insufficiency of the supply became more apparent, and we had to shut off the water during the night for some parts of every year. Under these circumstances, the Council began to seriously consider the question of an additional supply, which became more urgent in consequence of the persistent applications for water which were being received from parts of the district situated at a level too high to be dominated by our service reservoir. In 1903, the Council directed me to have an inspection made of the heading to which I have previously referred; and I obtained the services of two Forest of Dean miners to undertake this work. On their report, the heading was repaired and cleared up; and this improved our supply by at least 25 per cent.

As time went on, the number of consumers rapidly increased; and in 1907 the Council determined to make an attempt to provide an additional supply. We had found, after repeated examinations of the heading, that most of the water boiled up from the bottom; and this, combined with other local knowledge, enabled us to come to the conclusion that more water could be found by sinking a shaft for this purpose. The dip of the strata also assured us that in sinking a shaft we should not interfere with our existing supply.

This shaft was commenced during the spring of 1907, and sunk within a few yards of the mouth of the heading. The well was sunk in the old red sandstone; and the specification stated that it was to be 40 yards deep, lined with 9-inch brickwork, and the diameter 6 feet in the clear. In order to give the local miners a chance, tenders were invited for the sinking labour alone; the Council finding all machinery and driving power. Nine feet from the surface, rock was met with; and it remained rock right to the bottom. The boring was done by hand drills; and the explosive used for blasting is known as "Rippite," and was fired from the top of the shaft with an electric battery. The water was struck 45 feet from the surface, and gained in volume with every additional foot. We commenced the pumping with "Pulsometers," and got on fairly well until about 60 feet from the surface, when we began to experience considerable difficulty in keeping the well clear of water for the sinkers to proceed with their work. Pulsometers are excellent pumps, providing they have a constant supply of water to pump at, and if a good pressure of steam is maintained; but when anything goes wrong, and the pump gets hot, it is a most difficult job to start it again. In sinking operations, there are so many difficulties to contend with and guard against that the work is one continual worry. Sometimes the pump would be put out of action by the blasting, at other times the grit sucked into it would place the pump *hors de combat;* and before the steam could be turned off, the pump would get hot, and have to be cooled before another start could be made. At this period of the sinking operations, the water was coming into the shaft so fast that it would rise at such a rate as to render it necessary to draw up the men five minutes after the stoppage of the pumps. However, we struggled on until the shaft was 90 feet deep, and the yield of water after a wet season about 15,000 gallons an hour. In January, 1908, it was decided to suspend operations until the summer, as the quantity of water to be dealt with made the work costly to the Council and the contractor.

Sinking was again started in July, 1908. During the period of suspension, we had decided to go in for a different class of pump; and, after getting all the advice and information we could collect, purchased one of Evans's "Grif" pattern, specially made to suit our circumstances. Sinkers' pumping machinery and tackle is a speciality with Messrs. J. Evans and Co., of Wolverhampton; and I am bound to say that the service given by their pump was excellent, and the remaining 30 feet of the shaft—though the most difficult—was performed in about three months without any unexpected trouble.

The work was commenced in the spring of 1907; and, after being suspended during the winter months, was finished about the end of the summer of 1908. The experience gained in sinking this shaft I sum up as follows:

(1) That it is a mistake to make your shaft too small. If our shaft had been 8 feet instead of 6 feet in the clear, we should have performed the work much more rapidly and, I think, more cheaply. Pumping machinery to deal with a large quantity of water takes up so much space that the sinkers are hampered in a small shaft.

(2) That it is most inadvisable not to make your contract an inclusive one for both machinery and labour. When difficulties arise, the sinkers blame the machinery; and those in charge of the machinery blame the sinkers. This is not only unpleasant, but prejudicial to the conduct of the work.

(3) That it is advisable to provide and fix sufficient and positive pumping machinery as soon as pumping machinery is required, or, in other words, avoid all makeshifts or temporary expedients.

It may be interesting if I give the cost of this work.

	£	s.	d.
Sinking contract (labour only)	353	0	0
Labour (stokers, fitters, carpenters erecting pit-head framing, engine and boiler-sheds, &c.)	465	2	11
Machinery	656	2	1
Fuel	276	0	0
	£1750	5	0

Value of machinery and plant at conclusion of work, £602.

Before closing, I should like to give some statistics relating to the present size of our works, as compared with those previously given in the paper, and what may be considered as our present resources:

	1882.		1909.
Number of houses supplied	200	..	1900
Population	1000	..	9500

Average consumption at the present time, about 12 gallons per head per day—114,000 gallons per day.

During times of drought, our minimum supply from the heading is about 80,000 gallons per day. The minimum yield from the new shaft is about 150,000 gallons per day, so that we have a margin of 116,000 gallons. A considerable part of the northern portion of our district is not supplied. When it is, the greater part of our surplus yield will be wanted.

Hastings Corporation Bill.—A meeting was held last Tuesday at the Hastings Public Hall for the purpose of considering the Corporation Bill, which seeks power to borrow £100,000 for an extensive water scheme, to grant superannuation to workmen, to establish medical baths, and to effect sanitary and other improvements. The Mayor (Alderman Mitchell) presided over a crowded attendance. From the commencement, strong opposition was encountered to the Bill. A proposal to adjourn the discussion was not accepted; those present clamouring for a division. On the motion being put, two voted for the adoption of the Bill; the remainder of the meeting being absolutely averse to it.

Colwyn Bay Gas Managership.—A proposal that a salary of £250 a year should be offered for a Gas Manager to take the place of Mr. J. W. C. Pennington (whose resignation will become effective in March), and that the person appointed should devote the whole of his time to the duties, led to some discussion in the Colwyn Bay Urban District Council. Mr. Heenan said it was absurd to have two men taking charge of the gas and electricity concerns; and it would be more businesslike if these comparatively small undertakings were managed by one competent man. He moved that the matter be referred back with a view to one Engineer being engaged to control the electricity-works and the gas-works. Mr. Davies seconded; but, after a long discussion, the amendment was defeated by ten votes to seven, and consequently the Council will proceed to the appointment of a Gas Engineer only.

WATER SUPPLY OF NEW YORK CITY.

At the recent Meeting of the New England Water-Works Association, a paper on the above subject was read by Mr. William W. Brush. The following particulars are taken from some extracts from the paper given in "Engineering Record."

About 25 separate systems of water supply were used to serve the territory covered by the present city of New York; and practically all these systems have remained in use since the consolidation. The new supply from the Catskills is the first system that has been designed to supply water to all the boroughs comprising the greater city, and will practically cross-connect all the existing systems.

During the latter part of the Eighteenth and the early part of the Nineteenth centuries, several attempts were made to furnish a water supply from wells on Manhattan Island; but the quantity and quality were so unsatisfactory that the introduction of a water supply system for what is now the borough of Manhattan may be properly said to date from 1842, when water from the Croton River was first utilized, the population at that time being about 350,000. This was supplemented by an emergency supply from the Bronx and Byram rivers, which was introduced in 1884. The available supply from the Croton River was greatly increased by the construction of the new Croton aqueduct, which was put into service in 1890, and the extension of the Croton reservoir system, which is still in progress.

The Croton supply is taken from the river, about 30 miles north of the city, with a hilly, comparatively impervious, and rather sparsely settled watershed. The total tributary area is 360 square miles, of which about 19·3 square miles are water surface. The main or new Croton dam is about 6 miles from the point where the river joins the Hudson. This dam is of rubble masonry, faced with ashlar, having its foundation on rock; the lowest point of the foundation being 123 feet below the river bed at this point, the bed being 173 feet below the top of the dam. The crest of the spillway is at an elevation of 196 feet, and the water level can be raised by flash boards to 202 feet. The top of the dam is at 210 feet. The dam, including a spillway of 1000 feet, is 2163 feet long and contains about 850,000 cubic yards of masonry. Construction was commenced in 1892, and the works sufficiently completed to be used in 1905. The total cost, including land, was about $15,000,000. The reservoir formed by this dam is 20 miles long, and has a storage capacity at the spillway level of 38,000 million gallons, of which about 20,000 million gallons are above the invert of the aqueduct, and therefore ordinarily available. The original Croton dam, about three miles above the new one, is submerged by this reservoir to a depth of 34 feet.

Fourteen auxiliary reservoirs have been formed by masonry dams and earthen dikes, constructed on the various tributary streams and branches of the Croton. The stored water is discharged as required into the natural watercourses, and allowed to flow to the main reservoir. The Croton Falls reservoir, now under construction, will give an additional storage reservoir on what is known as the West Branch of the Croton River; and a diverting dam and channel will convey water from the East Branch into this reservoir. Upon the completion of this reservoir, the total available storage will be about 105,000 million gallons—equivalent to 290 millions per square mile of watershed.

The yearly rainfall on the Croton watershed averages about 48 inches; and the estimated safe minimum yield, based on the stream flows as measured since 1868, and assuming the completion of the Croton Falls reservoir, is 336 million gallons daily, which is equivalent to 930,000 gallons per square mile of watershed.

There are two aqueducts available to convey the water to the city. The old Croton aqueduct is 7 ft. 6 in. wide by 8 feet high, with a cross-section of about 53 square feet. Its slope is 1·1 feet per mile, and its capacity about 80 million gallons daily. It is 34 miles long, of which 4 miles are in earth or rock tunnel, the remainder being "cut-and-cover" section. The new Croton aqueduct is 13·6 feet wide and 13·5 feet high, with an area of 154 square feet. The slope is 0·7 foot per mile; and it has a capacity of 300 million gallons daily. The total aqueduct capacity for the old and new Croton is therefore slightly less than 400 million gallons daily. The aqueduct is almost wholly in rock tunnel, being 31 miles in length, of which only a little more than a mile is cut-and-cover.

The aqueducts are now connected to the Jerome Park reservoir, about 3 miles south of the northern city line. It is divided into two basins, the westerly one having been sufficiently completed to be put into use in 1905. The easterly basin is unfinished, as it was anticipated that it would be used in connection with a future filtration plant for the Croton supply. The reservoir has a flow-line at 134 feet; the bottom elevation being about 107 feet. The west basin has an area of 94 acres, and a capacity of about 770 million gallons. The old Croton aqueduct continues from this reservoir in cut-and-cover to the Harlem River, where it crosses in pipes over the High Bridge.

The new Croton aqueduct drops rapidly just north of the reservoir into a circular brick-lined tunnel, 12·25 feet in diameter, with its invert about 7 feet above tide water. A branch aqueduct connects the main conduit with the reservoir, and water from the latter can flow into the tunnel through a downtake shaft connected to a central gate-house. At the Harlem River the tunnel drops to an elevation of about 300 feet; the diameter reducing to 10 feet. On the west side of the river the tunnel is brought up to 13·5 feet. The pressure on this tunnel varies from about 50 lbs. per square inch for the land section to nearly 200 lbs. for the river section. From the gate-house the water is carried, mainly in 48-inch cast-iron mains, to the distribution system and to service reservoirs in Central Park. These reservoirs consist of three basins, the two southerly ones known as the old, and the northerly one as the new, reservoir. The normal flow-line is at 118 feet; and the capacity of the three basins is about 1200 million gallons.

About 75 per cent., or 250 million gallons daily, of the Croton supply is distributed from the low-level reservoirs, which gives a resulting hydraulic gradient in down-town Manhattan, during the daytime, equivalent to an elevation of about 70 feet. As a large area of the Bronx and Manhattan boroughs lies above the elevation which can be supplied from the low-level reservoirs, high services have been created by pumping the Croton water.

In the borough of the Bronx, the supply from the Bronx and Byram Rivers is delivered by a single 48-inch pipe, 15·2 miles long, from Lake Kensico, formed by a dam across the Bronx River at Kensico (N.Y.), to the Williamsbridge reservoir, located to the east of the Jerome Park reservoir. The watershed tributary to this lake is 22 square miles, and there are four lakes above Lake Kensico available for storage, having 2240 million gallons capacity, which, with Lake Kensico, makes 3870 million gallons. The supply, which averages about 20 million gallons daily, is used for the intermediate service in The Bronx. The Williamsbridge reservoir contains 140 million gallons, with the water level at 193 feet.

The distribution system of Manhattan and The Bronx consists of 1200 miles of mains, varying from 4 to 60 inches diameter, on which have been set 18,500 gates and 18,400 hydrants. There are something like 150,000 services, of which about one-third are metered. The average daily consumption of the two boroughs is about 325 million gallons. The original Croton works cost $12,000 000, and, with the additions since that time, including the Bronx and Byram works, have cost about $100,000,000.

In connection with the water supply system, a separate high-pressure service has been installed to reduce the fire loss and conflagration hazard in the down-town section of Manhattan. This system at present covers an area of about 1450 acres, within which 50 miles of mains from 12 to 24 inches diameter have been laid, with 896 gates and 1274 hydrants. There are about 5 miles of 8 inch pipe laid for hydrant connections, with an 8-inch valve on each connection. The mains are supplied by two pumping-stations—one on the East River and the other on the Hudson. Each station is connected to use either the salt water from the river or the fresh water from the Croton system; it being expected to use salt water only as an emergency supply. Each station has five six-stage turbine pumps driven by electric motors, each pump being capable of delivering 3000 gallons per minute against a head of 300 lbs. per square inch at the station. Each hydrant is equipped with three 3-inch and one 4½-inch outlet, and approximately ten lines of hose can be run from each hydrant. The high-pressure system has cost somewhat less than $4,000,000 for stations, including land, mains, and appurtenances; and extensions now in progress are estimated to cost about $1,500,000.

Brooklyn was dependent upon individual private and public wells and cisterns prior to the introduction of water from the Ridgewood system in 1859. At that time, the population was about 250,000, and the total area of the city was less than half of the present borough. The original works extended about 12 miles along the south shore of Long Island; and in 1890 an additional supply was obtained by an extension eastward of about 10 miles—the watershed area being about 159 square miles. The conditions of this watershed are exactly the reverse of those on the Croton shed, where huge storage of water on the surface is the only economical method of obtaining a large percentage of the rainfall. On the Brooklyn watershed the storage of a large quantity of water on the surface is practically impossible. There is only one reservoir that holds more than 50 million gallons; this being known as the Hempstead storage reservoir, which contains about 880 million gallons with a flow-line at 30 feet; this being equivalent to a depth of about 19 feet at the dam.

The supply from the Brooklyn shed is derived mainly from small streams on which shallow ponds have been formed, and from driven wells and infiltration galleries drawing on the sub-surface waters. This form of development is due to the geological character of the watershed, which, on account of its sand and gravel formation, absorbs nearly all the rainfall, amounting to about 43·5 inches yearly. The rainfall which does not evaporate and is not used for vegetation passes slowly through the upper sands to the saturated bed, and then flows towards the sea at a rate usually less than a mile per year. It is estimated that each year about 14 inches of rainfall flow through the streams, and about 12 inches pass out to the bays and ocean through the sands and gravels. Beds of clay, of a thickness varying from a few inches to about 50 feet, and of irregular shape and area, divide the underground flow into several strata.

Taking advantage of the natural stream and reservoir of filtered water that underlie the south side of Long Island, the supply from the surface streams has been supplemented, and to a large extent supplanted, by the sub-surface development. The first consisted of a large open well; but this was not successful in adding materially to the supply. In 1882, groups of 2-inch wells, about ½ mile from the tide water, where the water level was at from 5 to 10 feet, were driven to a depth of about 40 feet and connected to a central suction-pipe about 700 feet in length, laid at approximately the ground-water level. From 100 to 150 of these wells, with strainers 5 to 7 feet in length, were driven from each station; and by lowering the water level from 10 to 15 feet a supply of from 2½ to 5 million gallons daily was obtained. The system was later modified by increasing the diameter of the wells to 4½ to 8 inches, lengthening the strainers to 10 to 20 feet, and reducing the number of wells.

The supply from the eastern end of the watershed, amounting to from 60 to 70 million gallons daily, is drawn from four streams, five driven well stations, and two galleries. The supply is carried by gravity through a brick conduit to an intermediate pumping-station, known as the Millburn station. Here the water is raised from a pressure of 5 feet to one equivalent to an elevation of about 60 feet, and forced into three 48-inch mains, two of which carry the water to the main or Ridgewood pumping-station, located in the north-east section of the borough. The third 48-inch main discharges into the upper end of a brick conduit which runs through the westerly part of the watershed, and carries the water by gravity to the Ridgewood station, thirteen small driven well stations, one pond pumping-station, four combined pond and driven well stations, and three ponds delivering their supply directly into this conduit. A 72-inch steel pipe is now being laid parallel to the existing conduits, so that the water can be forced directly into the distribution system from several of the pumping-stations on the watershed. At the Ridgewood station, about 120 million gallons daily are pumped from an elevation of about 7 feet into the low service, which is fed by the Ridgewood distributing reservoir, having its flow line at 170 feet, and about 12 million gallons daily into the Mount Prospect reservoir, which has its flow line at 198 feet. There are four driven well stations within the borough limits that

pump about 15 million gallons daily directly into the mains against the Ridgewood pressure.

The distribution system consists of about 870 miles of mains from 4 to 48 inches in diameter, with about 14,000 gates and 13,000 hydrants. There are about 145,000 taps, of which about 14,000 are metered. The total average daily consumption is about 145 million gallons for a population of 1,500,000, or 97 gallons per head. The total cost of the Brooklyn system has been slightly over $30,000,000. Three driven well stations, owned by private companies and furnishing about 10 million gallons daily, supply a portion of the borough.

There are two high-pressure fire-service systems in Brooklyn. The main one was installed in 1905-7, and protects a business and manufacturing district along the East River, running from the Erie Basin to the Navy Yard, and extending back approximately one mile from the river front. This area comprises about 1400 acres. The supply is furnished by two stations; the main one being located on the river front, and the reserve station opposite Fort Greene Park. The total cost of the installation, which, in addition to the stations, includes about 21 miles of 12-inch to 20-inch mains, 1000 gates, and 730 hydrants, was about $1,300,000. Extensions are to be made to the pipe system, at an estimated cost of $750,000. The Coney Island high-pressure system was installed in 1904-5, and protects the amusement section of Coney Island. The pumping-station is located on Coney Island Creek, and can obtain its supply either from the Ridgewood system or from the salt-water creek. The equipment of this station consists of three Nash gas-engines, connected to Goulds triplex pumps; each unit having a capacity of 1500 gallons per minute against a pressure of 150 lbs. per square inch. The total cost of the installation, including about 1·2 miles of 12-inch to 16-inch mains, with 61 gates and 47 hydrants, was about $100,000. Extensions to the system are now under way; the estimated cost being about $150,000.

The safe supply from the systems utilized for all the boroughs, with the possible exception of the borough of Queens, is not sufficient to meet the requirements of the consumers during a period of drought similar to that which has been experienced for several years—the increase in supply obtained by the construction of new reservoirs on the Croton watershed, and the additional development of the underground supply of Long Island, hardly keeping pace with the increase in consumption; and further relief from such development is impracticable. As a result of an agitation for an additional supply, the Board of Water Supply was created by the Legislature in 1905 to construct the necessary works. The watersheds adopted for the new supply consist of Esopus, Rondout, Schoharie, and Catskill Creeks in the Catskill Mountains. The waters of the Schoharie Creek are to be delivered by tunnel into the valley of the Esopus; branch conduits being planned to convey the Rondout and Catskill waters to the main aqueduct. The Ashokan reservoir is now being developed in the Esopus Valley, and from it an aqueduct to deliver 500 million gallons daily is under construction. A large receiving and storage reservoir is to be constructed on the site of Lake Kensico, previously mentioned; and a distributing reservoir on the high ground just north of Van Cortlandt Park. The Kensico reservoir is to have a capacity of about 40,000 million gallons, with a water surface 355 feet above tide. The dam is to be of masonry, 1830 feet long and nearly 300 feet from the crest to the deepest part of the foundation.

The terminus of the Catskill aqueduct will be in the Hill View reservoir, which will be used as an equalizing basin, and will hold approximately 900 million gallons. The flow line is to be 295 feet above tide, the depth to be 36 ft. 6 in., and the water surface about 3000 feet long by 1500 feet wide. A central wall will divide the reservoir into two basins. South of the reservoir, it is expected to construct a pressure tunnel under the borough of The Bronx, crossing the Harlem River just below High Bridge, running through the borough of Manhattan, and crossing into Brooklyn under the East River, just below the Navy Yard. This tunnel is to be of sufficient size to carry the supply delivered by the Catskill aqueduct; and borings are now being made to determine the character and elevation of rock that is to be penetrated. Connections at the various shaft sites to the pipe system are to be provided for the delivery of the Catskill water into any part of the boroughs of Manhattan and The Bronx. For Brooklyn and Queens, large pipes will be required, as the conditions are not favourable for the economical extension of the tunnel system. For Richmond, submerged pipe-lines will be laid across the Narrows, and a reservoir constructed to equalize the pressure and safeguard the supply for the borough.

The Water Board have carried on extensive preliminary surveys and investigations to determine the available supply from the undeveloped watersheds of Long Island; and they recommend that the south and easterly sections of Suffolk County be utilized for Brooklyn, Queens, and Richmond by drawing from the sub-surface flow. The Board of Estimate and Apportionment approved last year the utilization of this source of supply; and the State Water Commission were requested to authorize its development for New York City. Opposition was encountered from owners of large estates within the watershed; and the Commissioners have not yet approved the petition of the city.

East Grinstead Gas and Water Company's Bill.—The East Grinstead Urban District Council have decided to present a petition against the Bill which the local Gas and Water Company are promoting. At the meeting at which this determination was come to, the Chairman (Mr. J. Rice) said the Council were not antagonistic to the Company; but they had a clear duty in the matter. Some years ago, a Bill was passed through Parliament that was not altogether advantageous to the town. They knew from bitter experience that many clauses were not included in it that should have been; and now that the opportunity had come—not by the Council's making—of getting certain concessions from the Company, he thought the Council should take it. A meeting of the Council had been called so that they might put themselves in the best possible position to get the things they required inserted in the Bill. A Committee of six was appointed to go into details and frame requirements for submission to a future meeting of the Council.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Wishaw Town Council on Monday, the Convener of the Gas Committee—Bailie Bell—reported that the average price of gas to prepayment meter consumers in thirty-five burghs in Scotland was 7d. per 1000 cubic feet more than the price to consumers by ordinary meters, as compared with 4d. per 1000 cubic feet in Wishaw. For the year to May, 1909, the gas consumed through ordinary meters was 41,752,000 cubic feet; and the cost of upkeep and time surveying for a year to November, 1909, was £22 10s. During the year to May, 1909, the gas consumed through prepayment meters amounted to 20,837,000 cubic feet, and the extra revenue upon this quantity, at 4d. per 1000 cubic feet, was £347. The cost of repairs, time surveying, &c., for a year to November, 1909, was £351; so that there had been a slight loss at 4d. Prepayment meters also cost about 10s. each more than ordinary ones. The Gas Manager had been instructed to prepare annually an estimate of the depreciation at the gas-works, to be submitted to the Scottish Office. The action of the Gas Committee was approved by the Council.

In connection with the movement for the purification of the air of Glasgow, the Gas Committee of the Corporation appointed a Sub-Committee to make arrangements for the delivery of a course of lectures to demonstrate the advantages to be derived from the use of gas for cooking and heating, as well as for lighting purposes. The Sub-Committee have made arrangements for the delivery of ten lectures in different parts of the city. In addition, Mr. A. Wilson, the Gas Engineer, will lecture, on Wednesday, Feb. 9, in the High School Hall in Elmbank Street, under the auspices of the Glasgow Health Culture Society, on which occasion Mr. M. W. Montgomery, the Convener of the Gas Committee, will preside. Lord Provost M'Innes Shaw has called a meeting of citizens to consider the subject, to be held in the City Chambers on Wednesday, the 16th prox.

In the political struggle which is in progress at present, it is not to be expected that much will transpire which ought to find its way into the pages of the "JOURNAL;" and the only incident of this nature which I observe is a reference to the price of the Granton Gas-Works site. Speaking at Garvald on Wednesday, Mr. B. Hall Blyth, of Edinburgh, who is the Unionist candidate for Haddingtonshire, referred to a speech recently made at that place by Treasurer Leishman, of Edinburgh. He said the Treasurer had referred to the land acquired at Granton by the Edinburgh Gas Commissioners from the Duke of Buccleuch, and had held the Duke up to ridicule for having demanded a high price for land which the Treasurer contended owed its development to the community and not to the Duke. He (Mr. Blyth) could speak with knowledge on this subject, having been employed by the Duke to value the land at Granton. The land was sold to the Corporation for £100 an acre. The Gas Commissioners hunted high and low for ground, and this was the best and cheapest they could get. Treasurer Leishman had said that the Duke of Buccleuch had done nothing to develop the ground. The Duke's father spent £600,000 in making a harbour at Granton; and this, with the Duke's private railway and several other considerations, gave the ground such advantage that the Edinburgh Corporation were able to buy coal cheaper now than they were ever able to purchase it at the old site of the gas-works, and Edinburgh gas consumers were getting the benefit. To these remarks Treasurer Leishman replied in a letter to the Editor of the "Scotsman," published yesterday, in the course of which he pointed out that he did not hold the Duke of Buccleuch up to ridicule, as it was the system he attacked and not the individual. If a sum of £100 per acre had been the price, nobody could say much, as he believed this figure to represent a fair value for the land. Instead of this sum, however, he found, from official records, that the site of the Granton Gas-Works, consisting of 106¾ acres, was sold for a total sum of £124,000; being at the rate of £1167 10s. 7d. per acre. The making of Granton Harbour was a commercial transaction, and had nothing whatever to do with the value of agricultural land. It was simply not true that the Gas Commissioners were buying coal cheaper now than they ever did before. Figures were given to show this; and it was argued that the site of the gas-works had no effect upon the price of coal, as the railway rates were the same to both the old and the new gas-works. Mr. Blyth was thus wrong as to the price of the site, and as to the effect of the site on the price of coal.

Three weeks ago, I mentioned that the Gas Committee of the Dundee Corporation had before them the question of the advisability of applying for a Provisional Order authorizing them to borrow £120,000, to cover estimated capital expenditure in connection with the gas undertaking till 1920. The subject was then remitted to a Committee to consider; the proposed amount being regarded as very large. The Committee seem to have taken the same view, because the recommendation which came before the Town Council on Thursday was that power be asked to borrow only £65,000. Mr. W. F. Burke considered that, as more money was required, they should ask for more, and so save the expense of a second Provisional Order. Treasurer Soutar explained that £65,000 was essential, but that it would meet requirements for the next five years. The Council agreed to the recommendation.

Sheriff-Substitute Glegg had before him in the Small Debt Court in Glasgow on Wednesday an action by Patrick Sweeney, dock labourer, in which he sued the Corporation for £20 as damages for personal injuries alleged to have been sustained by him through falling down an unlighted stair at No. 51, Wigton Street, Canal Bank, where he resides. It was stated for the pursuer that the stair had not been lighted for three weeks prior to the accident; and it was maintained that the Corporation were responsible for the state of matters. On behalf of the Corporation, it was argued that, the pursuer having used the stair with a full knowledge of its condition, he ought to be held responsible for the injury he sustained. The Sheriff upheld the defence, and dismissed the action, with expenses.

The burgh officials of all grades in Broughty Ferry held a most successful *conversazione* and dance in the Good Templar Hall last

I am M.P.
among
RADIATORS.

LET me explain. "M.P." stands for "Most Popular" and "Most Progressive," and there are reasons for my ELECTION to this place of honour. Modest I may not be, but in simplicity I excel. Herein am I a RADICAL reformer. I am not LIBERAL in the matter of gas consumption, but most sparing. I am CONSERVATIVE, though, in uniform distribution of heat. Initial cost and upkeep are with me at their lowest, from which follows FREE TRADING to an extent of which I am justly proud.

A Steamless Radiator,

Representing:
THE DAVIS GAS STOVE CO., LTD.,
LUTON.

Tuesday evening. The arrangements for the entertainments were mostly in the hands of Mr. G. Keillor, the Gas Manager, who was duly thanked for his services.

A unique exhibition is being held in Glasgow; the exhibits consisting of primitive apparatus for lighting and heating. It is situated in a building in Castle Street, fronting Cathedral Square, known as Provands' Lordship, which is claimed to be the oldest house in Glasgow. The exhibition is thus appropriately housed. It is an interesting collection. There are exhibits of flint and steel, by means of which lights were raised before the days of lucifer matches. Of lamps there are many, of numerous types, from ancient stone vessels and the oil-lamp known as the "cruisie," in iron and brass, in which rushes were used as wicks, to the modern incandescent gas-lamps, by means of which the venerable building is now lighted. There are lanterns of many sorts, including a specimen of the street-lamps used in Glasgow when oil was the illuminant, a specimen of the first type of street gas-lamp used in Glasgow, and hand lanterns used for lighting the street-lamps in Glasgow and Aberdeen. Rob Roy's lantern—a wooden case with glass in the four sides of it—and a collapsible burglar's lantern, are shown. Candlesticks and candelabra are in great variety; among them being a chandelier which was for long used in the lighting of the Parish Church of Rothesay. The heating appliances on view consist mostly of ancient fireplaces, hearths for burning peat, and coal and charcoal grates, in the latter of which there has been some attempt at the introduction of ornamentation. An hour passed in the exhibition is time well spent; the educative influence of the collection being great, illustrating, as it does, the slow but untiring efforts of mankind in the direction of furnishing himself and his surroundings with better means of procuring light and heat.

Warminster New Water-Works.—Last Wednesday, Mr. E. J. Bradfield, the Chairman of the Warminster Urban District Council, formally inaugurated a new installation of machinery in connection with the water supply of the town. Mr. C. H. Lawton (the Engineer of the works) presented Mr. Bradfield and Mr. J. E. Cornish (Chairman of the Water Committee) with silver keys as souvenirs of the day's proceedings. The plant consists of a 35 B.H.P. suction gas-engine and high-speed pump. Mr. Bradfield afterwards hospitably entertained the members and officials of the Council, and in the course of a few remarks said it was seventeen years ago that the old duplex steam-engine and turbines were installed at the works. These had answered the purpose well, and it was hoped to retain them for any case of emergency. With the new plant, they were now thoroughly up-to-date; and if the present yield of water kept up, they would be able to ensure for the town a constant supply. The total amount of the loans taken up was £11,295, and with £6712 repaid, they still had a sum of £4583 outstanding. He thought they could congratulate themselves and the town on the happy position they were now in. Mr. Cornish proposed a vote of thanks to Mr. Lawton and the Contractor (Mr. A. Titt), who had carried out their duties so well.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 22.

Sulphate of Ammonia.

During the past week the market has continued very firm, although direct demand has hardly been so good. Dealers apparently still require further quantity to cover former sales; and this circumstance has been sufficient to fully maintain values, while in some instances a small advance has again been scored. The closing quotations are £11 12s. 6d. per ton f.o.b. Hull, £11 13s. 9d. to £11 15s. per ton f.o.b. Liverpool, and £11 16s. 3d. per ton f.o.b. Leith. There is no new feature to comment upon in the forward position, which remains neglected for the most part; but it is reported that prompt price has been paid f.o.b. Leith for February and March delivery.

Nitrate of Soda.

No further reduction has been made in the price of this article, and the value is still given as 9s. 1½d. per cwt. for ordinary and 9s. 4½d for refined quality, on spot.

LONDON, *Jan.* 24.

Tar Products.

The market for tar products has been firm throughout the past week. Pitch is slightly better, and there is certainly more inquiry for this article. In creosote, the distillers are firmer in their ideas of price. In the 90's quality benzol, though makers are asking considerably higher prices, no large transactions are reported; and it is certain that the Germans are underquoting the English makers.

The average values during the week were: Tar, 14s. 6d. to 18s. 6d., *ex* works. Pitch, London, 30s. 3d. to 30s. 9d.; east coast, 29s. 3d. to 29s. 9d.; west coast, 29s. 3d. to 30s. 3d. f.a.s. Mersey ports, 29s. 3d. f.o.b. others. Benzol, 90 per cent., casks included, London, 6¾d. to 7d.; North, 6d. to 6¼d.; 50-90 per cent., casks included, London, 7¼d.; North, 6¾d. to 7d. Toluol, casks included, London, 9¾d. to 10d.; North, 9¼d. Crude naphtha, in bulk, London, 4d. to 4¼d.; North, 3⅝d. to 4⅛d.; solvent naphtha, casks included, London, 1s. 1½d. to 1s. 2d.; North, 1s. 0½d. to 1s. 1½d.; heavy naphtha, casks included, London, 11⅜d.; North, 10¾d. to 11d. Creosote, in bulk, London, 2½d. to 2⅝d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2⅞d. Carbolic acid, 60 per cent., casks included, east coast, 11½d. to 1s.; west coast, 11½d. to 1s. Refined naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article remains steady, and there does not seem to have been quite so much buying. In London, the principal Gas Companies are quoting £11 15s. for forward delivery; but outside makes can be obtained at about £11 6s. 3d. In Hull, £11 12s. 6d. is asked, and in Liverpool, £11 15s. 0d. In Leith, the majority of makers seem to be sold out for prompt, and for forward are asking £11 15s. In Middlesbrough, business has been done at £11 15s.; but for July-December, slightly under this can be obtained.

ONE Bland Mantle used regularly for 3 YEARS and STILL burning!!!

Read the following Unsolicited Letter:—

Dr Sir

I have used your Burners that I had from you in my shop regular which I think is nearly 3 years and I have the same mantle on now that I started with and it still gives a good light you can make use of this if you think Right also my name and any one can see the Burners in my shop at Work

I remain yours Respectfully
A W Teall
Ironmonger &c
Post Head Gloucestershire.

Dec 14th 1909

Samples and Quotations of both UPRIGHT and INVERTED Mantles on application.

THE BLAND LIGHT SYNDICATE, LTD., 63, Queen Victoria St., London, E.C. 20, Fennel Street, Manchester.

Telephone: 5720 (2 lines) London Wall. Telegraphic Address: "BLANLITE LONDON."

COAL TRADE REPORTS.

Northern Coal Trade.

There is now a partial settlement of the difficulty in the northern coal trade, and steam coals are fairly plentiful, though gas coals are still somewhat scarce. The Northumbrian collieries are turning out fair supplies, on the average; and best steams are from 10s. 9d. to 11s. 3d. per ton f.o.b. Second-class steams are 10s. 6d.; and steam smalls from 6s. 3d. to 6s. 9d. It is probable that as the output grows full the shipments may be more regular; but this is the quiet season, and prices are not very firm. In the gas coal trade, there is now some enlargement of the output, though important collieries are idle, and there are arrears of contract shipments to make up. Prices are still very irregular; but as far as quotation can be made, Durham gas coals are from about 11s. to 12s. per ton f.o.b., and sales of some 50,000 tons of best coals are reported for shipment over this year at about 11s. 6d. per ton f.o.b. Of course, the stoppage of many pits for three weeks has helped to make gas coals scarce at this season. Coke is firm for the same reason; and good gas coke is from 13s. 6d. to 14s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

There is a well-maintained demand for all classes of coal, which is helped by the difficulty with the miners in the North of England. The prices now quoted are: Ell, 10s. 3d. to 11s. 6d. per ton f.o.b. Glasgow; splint, 11s. to 11s. 3d.; and steam, 9s. 6d. to 9s. 9d. The shipments for the week amounted to 263,049 tons—an increase of 19,179 tons upon the preceding week, and of 64,972 tons upon the corresponding week of 1909. For the year so far, the shipments have amounted to 416,039 tons—an increase of 76,960 tons over the corresponding period of last year.

Public Lighting at Paignton.—The question of the public lighting was under consideration at a meeting of the Paignton District Council yesterday week. The Surveyor, in a report on the subject, stated that the present gas lighting with flat-flame burners was very unsatisfactory; and he recommended that incandescent burners of the Kern type be substituted for them. A letter from the Manager of the Gas Company stated that they were prepared to consider an arrangement for improving the lighting, subject to an agreement for five years. They would substitute new lanterns of the best copper pattern, and incandescent burners for the old lanterns and burners, and maintain, clean, light, and extinguish them at an inclusive charge, varying according to the burners used. The Surveyor reported that the terms offered would effect an annual saving of £95 10s., and the lighting would be much improved. The Lighting Committee recommended the acceptance of the Company's offer, subject to the right of the Council to remove 10 per cent. of the lamps in any one year, and also to a discount of 2½ per cent. on the total amount of the quarterly accounts. The report was adopted.

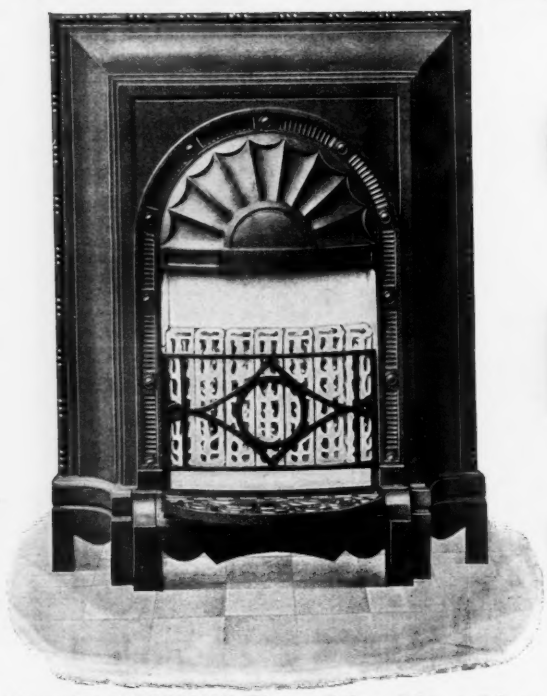
Hard Labour for a Gas Company's Official.

At the East Ham Police Court last Tuesday, Alfred Carter was charged on remand with making false entries in books belonging to the Gaslight and Coke Company, and further with stealing various sums of money from the Company by procuring it to be paid to Albert Luckin and Henry Honeyball by false entries. As already reported, the allegation against the prisoner was that, in his position as timekeeper over the men working in the coke department, he had made false entries in books, with the result that the two men mentioned had received wages to which they were not entitled, and had shared the money with the prisoner. Mr. Levick (for the defence) now stated that if the Magistrate would deal with the case, the prisoner would plead "Guilty." Mr. Humphreys (for the prosecution) stated that the Directors had left the matter in his hands, and he desired to leave it to the Magistrate. The plea was accepted; and Mr. Levick pointed out that the prisoner was already a ruined man, and had lost a position which he had held for 18 years. The Magistrate said there were two bad features about the case. In the first place, the plan of peculation must have been very carefully prepared. In the second, the prisoner must have corrupted those in a humbler position than himself. The least he could do was to pass sentence of three months' hard labour.

Gas Companies' Standard Burner Bills.—These three Bills came before one of the Examiners of Standing Orders proofs last Thursday. Compliance was reported; and the Bills were passed for first reading in the new Parliament.

Sanitary Condition of the Beckton Gas-Works.—At the meeting of the Woolwich Borough Council last Thursday, Dr. S. Davies, the Medical Officer of Health, presented a report upon the sanitary condition of the Beckton Gas-Works. He said 3241 men were employed in the works, and about 2000 were engaged at one time. He had inspected the works with regard to their sanitary condition, and was pleased to report that, on the whole, he found this decidedly satisfactory. It was very gratifying to note that the Gaslight and Coke Company paid special attention to the personal well-being of their employees. A large amount of money had been spent in building rooms where the men could prepare and eat their meals, and also wash and bathe themselves. These rooms were well equipped with large lavatory basins, supplied with hot and cold water, and also with spray baths; and they were well and increasingly made use of. The Borough Council, at their dust destructor, and the Gas Company had set an example, in respect of making provision for the cleanliness of their employees, which it was much to be desired should be followed by other employers of labour in the borough, including the Government. Such provision might appear to be, to a certain extent, a luxury, or be regarded as yielding to the "sanitary fad;" but he believed that where it had been tried it had been found not only to increase the health of employees, but also to be advantageous to their wage-earning capacity, and thus would ultimately prove a money-saving expenditure.

GENERAL ELECTION NOW IN PROGRESS.



"GAINSBOROUGH" Fire. Price 24s. subject.

When the Gas Fire

(S)ELECTION

took place last October,

MAIN'S GAS FIRES

obtained

FIRST PLACE BY A HUGE

MAJORITY.

R. & A. MAIN, Ltd.,

Gothic Works, EDMONTON, LONDON, N., & Gothic Works, FALKIRK, N.B.

Dumping German Gas-Mantles in England.

The following letter on the above subject, signed "Director," appeared in the "Daily Telegraph" last Friday: "This unfortunate country has been marked down as a dumping-ground for cheap German incandescent mantles, the better qualities of which are used by British gas companies, and the lower-grade qualities are retailed in the poorer districts. The mantles are sold almost exclusively by German agents, who naturally contribute to our Exchequer, through their income-tax; but the bulk of the spoil goes to the German exporter, who contributes nothing. As a Director of a mantle-manufacturing Company in the East-end, I am in a position to judge what effect this competition has on labour alone. We employ some 100 to 150 steady, hard-working girls; but could we obtain a fair share of the business of the 50 million imported mantles, we could employ probably 300 girls. We make a mantle as good as, or even better than, the imported one; but the latter is dumped here at a price which is simply ruinous, and cannot yield the Germans a profit. It is simply their surplus production."

Slight Explosion at Limavady Gas-Works.—Last Thursday afternoon, while the Manager (Mr. Robert Gault) and some men were working in the station meter and governor house at the Limavady Gas-Works, there was a slight explosion. They were engaged in removing an obstruction in the main leading to the gasholder; and the Manager was undoing the connections, when, it is surmised, the hammer with which he was working caused a spark, resulting in an explosion. A stoker was blown into the yard, but was not much injured. The Manager was somewhat singed, and another man was also slightly burned. The slate roof was blown off the house; and the walls were shaken and damaged.

Devonport Corporation and the Water Engineer.—A proposal was submitted to the Devonport Town Council last Thursday for the increase of the salary of Mr. F. W. Lillicrap, the Water Engineer. The Water Committee recommended that Mr. Lillicrap's remuneration should be raised at once from £310 to £350 a year, and further increased to £450 by annual increments of £25. Alderman Blackall, the Chairman of the Committee, said Mr. Lillicrap had saved the Corporation £4500 in engineer's fees on works carried out since the Corporation took over the water supply. Mr. Ellis, the Chairman of the Finance Committee, moved that the recommendation be referred back to the Water Committee. He admitted that Mr. Lillicrap had done good service to the Corporation, but pointed out that the time was approaching when they would have to meet serious additional charges on account of the water undertaking, which would add considerably to the ratepayers' burdens. Mr. Lillicrap was appointed at a salary of £250, rising to £350, and had not reached this figure. If he had a claim for extra work, it should be met by a gratuity. The amendment of Mr. Ellis was carried by 41 votes to 9. After some discussion on the question of immediately advancing Mr. Lillicrap's remuneration to £350 per annum, it was decided that the whole subject should be further considered by the Water Committee.

Tenders for the Lighting of Newton Abbot.—Two tenders for the public lighting of Newton Abbot were laid before the Urban Council of the town yesterday week. One was from the Electric Lighting Company, who offered to undertake the work for £766 per annum; and the other from the Gas Company, who required £800. The Council's Accountant said they had been paying £950 per annum hitherto. It was decided to refer the matter to a Committee, for them to obtain a report as to two sample lamps put up.

Power-Gas Corporation, Limited.—The ninth ordinary general meeting of this Company was held at the Westminster Palace Hotel last Friday—Mr. Alfred Mond, M.P., in the chair. In moving the adoption of the report, noticed last week (p. 194), the Chairman said the result of the year's trading was a profit of £3779, which was £1500 more than in the preceding twelve months. The general engineering business had been better, and they had booked some good contracts, including one of £60,000 for the Calcutta Corporation, which was in course of execution. At the present time there were orders in hand sufficient to keep the works well employed for at least twelve months. The outlook for makers of producer gas and for gas-engine builders was brighter now than it had been at any other period. In Tuscany, a Mond peat plant, with sulphate of ammonia recovery, was now being used to supply an entire district with electricity produced from gas-engines. People were getting more accustomed to the use of these engines as a normal type of driving; and this, of course, would very much facilitate business. On the whole, he thought the Company's position next year should be better than it was now. Mr. E. Lloyd Pease seconded the motion; and it was carried.

Colwyn Bay Urban District Council Finances.—In his report to the Colwyn Bay Urban District Council, the Government Auditor (Mr. William Griffith) states that last year there was a deficiency in the district fund of £1092, in the gas supply fund account of £1921, and in the electricity supply fund account of £1662. There were bank overdrafts on these accounts as follows: District fund £2758, gas fund £4647, electricity fund £2637—which is equivalent to a 2s. 9d. rate. As to the gas and electricity accounts, during the three years ended March 31, 1908, the two concerns contributed £6868 in aid of the general district rate. In accordance with the provisions of the Acts, the total deficiencies in the revenue of the Council on account of the three funds (to be made good out of the next general district rate) amounts to £4677, which would be equivalent to a rate of 1s. 3d. The Auditor makes several suggestions with a view to the better keeping of the accounts. He says: "With regard to stock in store, I would point out that there are no registers of gas cookers and meters; and a postage account is not kept in the gas office. The repayment of all deposits should, in my opinion, be made through the Accountant. . . . I would suggest that an independent person should be appointed to take stock at the close of the year." Reference is made to friction which is alleged to exist between the Gas Accounts Department and the Accountant's Department, and is said to militate against efficiency. The Council have agreed to carry out the suggestions contained in the report.

SAWER & PURVES,

THE POSITIVE DRY PREPAYMENT METER

MANCHESTER & NOTTINGHAM.

Agent for Scotland: JNO. D. GIBSON, 2, Causeyside Street, PAISLEY.

Price of Gas at Barnet.—At the last meeting of the East Barnet Urban District Council, a letter was read from the Manager of the Barnet District Gas and Water Company, in reply to one which had been received by the Company containing a copy of a resolution passed by the Council with reference to the price of gas. He was instructed to inform the Council that the Directors were desirous of announcing a reduction at the earliest possible moment; but until they had the result of the last half-year's working before them, they were unable to come to a decision. He pointed out that the price of coals had been raised for this year, and that the Company had had notice of a reassessment of their property for rating purposes. They considered they were now greatly over-assessed, as for every 1000 cubic feet of gas sold they paid more than 3d. in rates and taxes, which was considerably in excess of other companies. They had recently been at great expense in reconstructing their works and enlarging their mains, so as to give all consumers an ample and satisfactory supply; and they had also opened show-rooms for gas appliances, and engaged competent men to give consumers expert advice. These additional expenses were nearly completed; and the Directors hoped that the improved results would be such as to warrant their reducing the price of gas at an early date. The letter was considered by the Council as very satisfactory; one member remarking that it showed that the Company were anxious to keep abreast of the times.

Messrs. Trier Bros., engineers and manufacturers, notify a change of office address from Great George Street, S.W., to Caxton House, Westminster.

The British High-Power Gas-Engine Company, Limited, which was registered a few weeks ago for the purpose of supplying high-power gas-engines, have adopted an engine of the double-acting four-cycle type.

The Sherborne Gas and Coke Company has been registered with a capital of £11,000, in 2200 shares of £5 each, to carry on the business of gas supply. The Company was registered as an unlimited concern in 1875; and it has now been re-registered.

The second annual dinner of the staff of the Bryan Donkin Company, Limited, was held on the 14th inst., at the Hotel Portland, Chesterfield. The chair was occupied by the Managing-Director (Mr. G. Clark), who was supported by his co-Directors, Messrs. H. J. Donkin, N. W. Burbidge, and A. G. Webb; and the company, which numbered between thirty and forty, included the staffs of the offices and works and the district representatives. Mr. W. A. Hopkins proposed "The Bryan Donkin Company," and referred to the prominent part they had taken in all the notable developments in the profession of engineering during the past century, especially in connection with the gas industry, with which the business of the Company was now mainly concerned. Mr. H. J. Donkin replied. Mr. N. W. Burbidge proposed "The Managing-Director," and read a letter from the Chairman of the Company (Mr. G. H. Shipley) expressing the satisfaction of the Board at Mr. Clark's work. The toast was acknowledged by Mr. Clark, who proposed "The Staff." The Works Manager (Mr. T. H. Haigh) replied. The final toast was "The Representatives;" and the proceedings closed with a vote of thanks to the Chairman.

APPLICATIONS FOR LETTERS PATENT.

640-1.—Glover, R. B. G., "Gas-lamps." Jan. 10.
642.—Stott, J. & V. H., and Schofield, L., "Water-heaters." Jan. 10.
653.—Boby, W., "Water measuring and recording appliances." Jan. 10.
658.—Parkinson, B. R., and Woodall, H., "Jointing of sections or lengths of metal tubes and pipes." Jan. 10.
700.—Blumenstein, F., "Gas and air heater." Jan. 11.
715.—Deutsche Gasglühlicht Akt.-Ges. (Auerges.), "Inverted incandescent gas-lamp." Jan. 11.
735.—Donnelly, S. H., "Ferrules for use with gas and water service pipes." Jan. 11.
739.—Lambton, J. W., and Fletcher, E. J., "Combined vertical and inverted gas-burner." Jan. 11.
753.—Aldridge, J. G. W., "Charges for gas-retorts." Jan. 11.
774.—Pausinger, F. von, "Alarm apparatus for preventing explosions and poisoning by gas." Jan. 11.
787.—Kemp, C. W., "Gas-fittings." Jan. 12.
826.—Benninghoff, C., and Klönne, A., "Gas-fired retort or chamber furnaces." Jan. 12.
830.—Zimmerli, E. M., "Bunsen burner for illuminating purposes." Jan. 12.
851.—Burch, A. R., "Gas-lanterns." Jan. 12.
864.—Colbran, J. B., "Globe-holders." Jan. 12.
873.—Jackson, S., "Tool to compress joints of pipes." Jan. 12.
890.—Rotherham, H., and Johnson, W., "Gas-burners." Jan. 13.
899.—Ely, B., and Rollason, A., "Treatment of waste chemical liquors containing sulphur compounds and cyanides." Jan. 13.
948.—Giorgi, A., "Gas-burners." Jan. 13.
991.—Schülzke, E., "Lighting and extinguishing gas-lanterns from a distance." Jan. 14.
1029.—Anderson, D., "Gas-lamps." Jan. 14.
1045.—Schuster, N., "Removing heavy hydrocarbons from the hot gases from gas-retorts and the like." Jan. 15.
1069.—Berry, J., and Meters Limited, "Controlling combined high and low pressure gas supplies." Jan. 15.
1090.—Earp-Thomas, G. H., "Gas-filtering devices." Jan. 15.
1095.—Krebs, L., "Indicating an escape of gas." Jan. 15.
1096.—Gibbons Bros., Ltd., and Marle, M. Van, "Charging and discharging vertical gas-retorts and carbonizing ovens." Jan. 15.
1115.—Schmidt, P., "Gas-fired furnaces." Jan. 15.

An inquiry on behalf of the Local Government Board has been held at Nuneaton by Mr. P. M. Crosthwayte, with regard to an application by the Council for sanction to borrow £5000 for the purpose of water supply and laying down a new main. The Town Clerk (Mr. F. S. Clay) informed the Inspector that the money was absolutely necessary. It was essential to put down a new main. The old main was laid in 1884; and the population had since increased three-fold. The present population in the area was 33,515. The new main would consist of 17,000 yards of cast-iron and 1000 yards of steel pipes.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 224.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,474,000	Stk.	Oct. 14	5	Alliance & Dublin Ord. .	85–87	..	5 14 11
310,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	98–100*	..	4 0 0
200,000	5	Oct. 28	6¼	Bombay, Ltd.. . . .	5⅞–6⅛	..	5 6 1
40,000	5	,,	6¼	Do. New, £4 paid .	4⅝–4⅞	..	5 6 8
50,000	10	Aug. 26	15	Bourne- ⎫ 10 p.c. . .	28½–29	..	5 3 5
311,810	10	,,	7	mouth Gas ⎬ B 7 p.c. .	16⅛–16⅝	..	4 3 7
75,000	10	,,	6	and Water ⎭ Pref. 6 p.c.	15⅛–15⅝	..	3 16 2
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	253–256	..	4 17 8
300,000	,,	,,	9⅜	Do. New . . .	190–192	..	4 19 0
50,000	,,	,,	5	Do. 5 p.c. Pref. .	120–122	..	4 2 0
206,250	,,	Dec. 29	4	Do. 4 p.c. Deb. .	99–101	..	3 19 3
220,000	Stk.	Sep. 10	11	Brighton & Hove Orig.	217–220	..	5 0 0
246,320	,,	,,	8	Do. A Ord. Stk. .	154–157	..	5 1 1(
460,000	20	Oct. 14	10	British	42⅞–43⅛	..	4 11 11
109,000	Stk.	Aug. 26	6	Bromley, A 5 p.c. . .	118–120	..	5 0 0
165,700	,,	,,	4½	Do. B 3½ p.c. . .	88–90	..	5 0 0
82,278	,,	,,	5⅜	Do. C 5 p.c. . .	106–108	..	5 1 10
55,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb. .	87–89	..	3 18 8
500,000	10	Oct. 14	7	Buenos Ayres (New) Ltd.	14¼–14⅜	+⅛	4 14 11
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .	98–100	..	4 0 0
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref. .	5⅛–5⅜	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	48–49	..	6 2 6
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	80–82	..	5 9 9
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord. . .	108½–110½	..	4 10 6
1,493,280	Stk.	Aug. 26	5⅛	Commercial 4 p.c. Stk. .	109–111	..	4 13 8
560,000	,,	,,	5	Do. 3½ p.c. do. .	103–105	..	4 15 3
475,000	,,	Dec. 29	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800 000	Stk.	Dec. 10	5	Continental Union, Ltd.	95–97	..	5 3 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	137–139	..	5 0 9
492,270	Stk.	—	5	Derby Con. Stk. . . .	121–123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk. . . .	103–105	..	3 16 2
148,995	,,	Oct. 2	5	East Hull 5 p.c. Ord. .	98–100	..	5 0 0
486,090	10	July 14	12	European, Ltd. . . .	24⅜–25	..	4 16 0
354,060	10	,,	12	Do. £7 10s. paid.	18¾–19	..	4 14 9
15,141,545	Stk.	Aug. 12	4⅜	Gas ⎫ 4 p.c. Ord. . .	104–105	+¼	4 8 10
2,600,000	,,	,,	3⅛	light ⎬ 3½ p.c. max. .	88–89	+⅛	3 18 8
3,799,735	,,	,,	4	and ⎭ 4 p.c. Con. Pref.	103–105	..	3 16 2
4,193,975	,,	Dec. 29	3	Coke ⎫ 3 p.c. Con. Deb.	81–83	..	3 12 3
258,740	Stk.	Sep. 10	5	Hastings & St. L. 3½ p.c.	94–96	..	5 4 2
82,500	,,	,,	6½	Do. do. 5 p.c.	118–120	..	5 8 4
70,000	10	Sep. 29	11	Hongkong & China, Ltd.	17⅜–18	..	6 2 3
131,030	Stk.	Sep. 10	6½	Ilford A and C . . .	144–146	..	4 9 0
65,780	,,	,,	5	Do. B	108–110	..	4 10 11
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb. . . .	100–102	..	3 18 5

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	8	Imperial Continental .	175–177	..	4 10 5
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	94–96	..	3 12 11
195,242	Stk.	Aug. 26	6	Lea Bridge Ord. 5 p.c. .	119–121	..	4 19 2
561,000	Stk.	,,	10	Liverpool United A . .	227–229	..	4 7 4
718,100	,,	,,	7	Do. B . .	167–169	..	4 2 10
306,083	,,	Dec. 29	4	Do. Deb. Stk.	103–105	..	3 16 2
75,000	5	Nov. 26	6	Malta & Mediterranean.	4⅛–5	..	6 0 0
560,000	100	Oct. 1	5	Met. of ⎫ 5 p.c. Deb.	99–102	..	4 18 0
250,000	100	,,	4½	Melbourne ⎭ 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd. . .	12⅛–13	..	5 7 8
1,775,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	107–108	..	4 3 4
518,795	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	91–93	..	3 15 3
55,940	10	Aug. 26	7	North Middlesex 7 p.c.	13–13½	..	5 3 8
300,000	Stk.	Nov. 26	8	Oriental, Ltd. . . .	137–139	..	5 15 1
60,000	5	Sep. 10	8	Ottoman, Ltd. . . .	6⅛–6⅜	..	6 5 6
31,800	53	Aug. 26	13	Portsea Island A. . .	137–139	..	4 19 0
60,000	50	,,	13	Do. B. . .	129–131	..	4 19 3
100,000	50	,,	12	Do. C. . .	122–124	..	4 16 9
114,800	50	,,	10	Do. D and E.	102–104	..	4 16 2
398,490	5	Oct. 28	7	Primitiva Ord. . . .	7⅛–7⅜	..	4 14 11
796,980	5	July 29	5	Do. 5 p.c. Pref. .	5⅛–5⅜	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	99–100	+1	4 0 0
1,000,000	10	Oct. 14	8	River Plate Ord. . .	17–17½	..	4 11 5
312,650	Stk.	Dec. 29	4	Do. 4 p.c. Deb. .	98–100	..	4 0 0
250,000	10	Sep. 29	8	San Paulo, Ltd. . . .	14⅛–15	..	5 6 8
62,500	10	,,	6	Do. 6 p.c. Pref. .	11⅝–12⅛	..	4 18 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb. .	50–51	..	4 18 0
135,000	Stk.	Sep. 10	10	Sheffield A	233–235	..	4 5 1
209,984	,,	,,	10	Do. B	233–235	..	4 5 1
523,500	,,	,,	10	Do. C	233–235	..	4 5 1
70,000	10	Oct. 14	10	South African	12⅛–12⅝	..	7 16 11
6,429,895	Stk.	Aug. 12	5⅛	South Met., 4 p.c. Ord.	120–122	..	4 7 4
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	81–83*	..	3 12 3
209,820	Stk.	Aug. 26	8	South Shields Con. Stk.	160–162	..	4 18 9
605,000	Stk.	Aug. 12	5½	S'th Suburb'n Ord. 5 p.c.	120–122	..	4 10 2
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120–122	..	4 2 0
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	120–122*	..	4 2 0
502,310	Stk.	Nov. 11	5	Southampton Ord. . .	110–112	..	4 9 3
120,000	Stk.	Aug. 12	6⅞	Tottenham ⎫ A 5 p.c. .	133–135	..	5 1 9
453,940	,,	,,	5⅜	and ⎭ B 3½ p.c. .	111–113	..	4 15 3
149,470	,,	Dec. 29	4	Edmonton ⎫ 4 p.c. Deb.	98–100	..	4 0 0
182,380	10	Dec. 29	8	Tuscan, Ltd.	9–9⅜	..	8 8 6
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	99–101	..	4 19 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	111–113	+1	4 8 6
255,636	Stk.	Aug. 26	6⅞	Wands- ⎫ B 3½ p.c. .	139–141	..	4 14 0
79,416	,,	Dec. 29	3	worth ⎭ 3 p.c. Deb. Stk.	73–75	+1	4 0 0

Prices marked * are "Ex div."

The Centenary Gas Company, of London and Glasgow, have received instructions from the War Office to erect one of their patent turbine petrol gas generators within a portion of the barracks at Salisbury Plain; and they are also to supply and erect all the gas-pipes, burners, mantles, &c., that may be required in connection with the installation.

At the meeting of the West Ham Education Committee on Monday last week, it was reported that a letter had been received from the managers of St. Luke's School to the effect that the incandescent gas lighting provided in the boys' department had proved eminently satisfactory, and asking that the same system of lighting should be installed in the girls' and infants' departments. This request is to be acceded to.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

WORKS SUPERINTENDENT. Walsall Gas Department. Applications by Feb. 12.
CANVASSING INSPECTOR. No. 5174.
MANAGER (Gas Meter, &c., Trade). Hapgood's, 166 and 167, Strand, W.C.

Situations Wanted.

ENGINEER'S ASSISTANT. No. 5173.
SULPHATE PLUMBING. Leadburner, 117, Galloway Road, Shepherd's Bush.

Plant, &c. (Second Hand), for Sale.

COMPLETE GAS WORKS PLANT (EXCEPT BUILDINGS). Particulars from the Eastbourne Gas Company.
EXHAUSTER AND ENGINE, GAS-METERS, SCRAP IRON, AND BRASS, &c. Ashton-in-Makerfield Gas Department. Tenders by Jan. 31.
PURIFIERS, SCRUBBERS, AND CONDENSERS. Edinburgh and Leith Gas Commissioners.

Patent Rights.

GAS STOVE UTENSILS. No. 5175.

Stocks and Shares.

ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY. Feb. 15.
NORTH MIDDLESEX GAS COMPANY. Feb. 15.
SOUTHGATE GAS COMPANY. Feb. 15.

Meetings.

COMMERCIAL GAS COMPANY. Cannon Street Hotel, Feb. 24, Twelve o'clock.
TOTTENHAM AND EDMONTON GAS COMPANY. Offices, Feb. 5, Three o'clock.

TENDERS FOR

Fire-Clay Goods.

HALIFAX GAS DEPARTMENT. Tenders by Feb. 8.

Carbon.

ASHTON-IN-MAKERFIELD GAS DEPARTMENT. Tenders by Jan. 31.

Cocks, Valves, Lamp Fittings, &c.

HALIFAX GAS DEPARTMENT. Tenders by Feb. 8.

General Stores—

(Oils, Paints, Lime, Brushes, Ironmongery, Steel Goods, Gaskin, &c., &c.)—
HALIFAX GAS DEPARTMENT. Tenders by Feb. 8.

Iron Work for Retort Bench.

SHEFFIELD UNITED GAS COMPANY. Tenders by Feb. 8.

Meters.

HALIFAX GAS DEPARTMENT. Tenders by Feb. 8.

Oxide of Iron (New and Spent).

ASHTON-IN-MAKERFIELD GAS DEPARTMENT. Tenders by Jan. 31.
HALIFAX GAS DEPARTMENT. Tenders by Feb. 8.

Pipes, &c.

HALIFAX GAS DEPARTMENT. Tenders by Feb. 8.

Sulphuric Acid.

HALIFAX GAS DEPARTMENT. Tenders by Feb. 8.
HERNE BAY GAS COMPANY. Tenders by Feb. 1.

Tar.

HERNE BAY GAS COMPANY. Tenders by Feb. 1.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1910, are reminded that this can only be done during the present month.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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See Advertisement on p. 259.
FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers, Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

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Applicants must be Experienced in the Duties and hold a similar Appointment in Gas-Works.

Canvassing will disqualify.

Applications accompanied by *copies* of not more than Three recent Testimonials and marked outside "Gas-Works Superintendent," are to be sent to me not later than Saturday, the 12th of February next.

John R. Cooper,
Town Clerk.

Walsall, Jan. 21, 1910.

WANTED, an Experienced and Well- Educated CANVASSING INSPECTOR, having a Complete Knowledge of all Gas Appliances and able to Interview Customers, Prepare Estimates, and Take Charge of Gas-Fitters.
Apply by letter, stating Age, Experience, and Salary required, with *copies* of not more than Three recent Testimonials, to No. 5174, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

CAST-IRON Pipes. Spigot and Socket or Flanged. Special Quality—9 feet or 12 feet Lengths. When buying, Write us.
A. Lowcock, Limited, Shrewsbury.

GASHOLDERS - Splendid 45 feet dia- meter and New STEEL TANK, fixed Complete to Plan and Specification; also 14 feet and 16 feet Diameter GASHOLDERS, with STEEL TANKS. Can be seen temporarily erected. Re-erected Cheap for immediate Sale.
Firth Blakeleys, Thornhill, Dewsbury.

SECOND-HAND GAS PLANT FOR SALE.
HAILSHAM, SUSSEX.
THE Eastbourne Gas Company, having acquired the Hailsham Gas Undertaking, invite TENDERS for TAKING DOWN and PURCHASING the Whole of the PLANT at the Hailsham Works (excepting buildings). Two small HOLDERS, Two BENCHES OF RETORTS, Nearly New Braddock's 6-inch GOVERNOR, STATION-METER ENGINE and EXHAUSTER (Waller), STEAM BOILER, PHOTO-METER, WORKS MAINS and SUNDRY SCRAP.
Further Particulars of Mr. John Hammond, Gas-Works, Eastbourne.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.
FIRST-CLASS SECOND-HAND PLANT.
THE Commissioners have for Sale the following PLANT, together with all Accessories, &c., for which they are prepared to receive OFFERS.
Two Sets of WATER-LUTE PURIFIERS, 24 feet by 19 feet.
One Set of WATER-LUTE PURIFIERS, 27 ft. 6 in. by 24 ft.
Two TOWER SCRUBBERS, each 60 feet High by 13 feet Diameter.
One Battery of WROUGHT-IRON ANNULAR CONDENSERS, 31 ft. 6 in. high. Inner Tube, 22 inches Diameter.
Detailed Specifications and Drawings can be supplied to Persons contemplating the Purchase of this Plant, and references given to other Works where similar Plant has been transferred.
For further Particulars and full Information, Apply to the undersigned.
W. R. Herring,
General Manager.
Calton Hill, Edinburgh,
Jan. 21, 1910.

URBAN DISTRICT COUNCIL OF ASHTON-IN-MAKERFIELD.
TENDERS.
THE above Council invite Tenders for the Purchase of the following—viz.:
About 50 to 60 Tons of SPENT OXIDE OF IRON, containing from 45 to 50 per cent. of Sulphur.
About 5 to 6 Tons of RETORT CARBON.
About 4 to 5 Tons of Heavy and Light SCRAP IRON, and 2 cwt. Light SCRAP BRASS.
One Round STATION METER, 8-inch Valves, Connections all complete, by Gas Meter Company.
One Dempster Reciprocating GAS-EXHAUSTER and STEAM ENGINE, with 8-inch Valves and Connections Complete.
130 Old disused Dry and Wet GAS METERS (Sizes 2, 3, 5, and 10 lights).
All Goods may be inspected at the Council Gas-Works, Princess Road, and further Information may be obtained, on Application, from the Gas Manager.
Sealed Tenders, endorsed with the name of the Goods tendered for, to be delivered at the Clerk's Office, Council Offices, Ashton-in-Makerfield, not later than the 31st of January, 1910.
By order,
Albert Sykes,
Clerk to the Council.
Council Offices, Ashton-in-Makerfield,
January, 1910.

COUNTY BOROUGH OF HALIFAX.
THE Gas-Works Committee of the Halifax Corporation invite TENDERS for the Supply of (1) CAST-IRON PIPES. (2) OILS, PAINTS, &c. (3) CLEANING WASTE. (4) BRUSHES. (5) IRREGULAR PIPES AND CASTINGS. (6) BRASS LAMP FITTINGS. (7) BRASS MAIN COCKS AND UNIONS. (8) OXIDE OF IRON. (9) LIME. (10) SULPHURIC ACID. (11) IRONMONGERY. (12) STEEL GOODS. (13) FIRE-CLAY GOODS. (14) IRON VALVES AND CONNECTIONS. (15) WET AND DRY METERS. (16) TARRED GASKIN. And for the PURCHASE of SPENT OXIDE OF IRON, during the Twelve Months ending the 31st of March, 1911.
Forms of Tender and further Information may be obtained on Application to Mr. J. Wilkinson, F.C.S., Engineer, Gas-Works, Halifax.
Tenders, properly endorsed, must be sent to the undersigned on or before Tuesday, the 8th of February, 1910.
The persons whose Tenders are accepted for the Supply of the above-mentioned Articles will be required to observe the Fair-Contracts Clauses adopted by the Corporation.
Herbert Ashling,
Town Clerk.

HERNE BAY GAS AND COKE COMPANY, LIMITED.

SULPHURIC ACID.

THE Directors are prepared to receive TENDERS, on or before Tuesday, Feb. 1, 1910, for the Supply of about 40 Tons of SULPHURIC ACID, to be delivered during the Year 1910.

Particulars of Contract and Form of Tender may be obtained from the undersigned.

The Directors do not bind themselves to accept the lowest or any Tender.

C. V. BENNETT,
Manager.

Beach Street, Herne Bay.

HERNE BAY GAS AND COKE COMPANY, LIMITED.

TAR.

THE Directors invite Tenders for the Surplus TAR produced at their Works during the Twelve Months ending the 31st of January, 1911.

Particulars of Contract and Form of Tender may be obtained from the undersigned.

Tenders to be sent in on or before Tuesday, Feb. 1, 1910.

The Directors do not bind themselves to accept the highest or any Tender.

C. V. BENNETT,
Manager.

Beach Street, Herne Bay.

TO ENGINEERS AND IRONFOUNDERS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the Supply of STEEL and IRON WORK for Twelve Settings of TEN RETORTS at their Neepsend Works.

TENDER No. 1.

For the Supply and Delivery only of CAST-IRON BUCKSTAY SHOES, ASH PANS, and FURNACE FITTINGS.

TENDER No. 2.

For the Supply and Erection of Steel and Iron Work, consisting of ROLLED STEEL JOISTS, CAST IRON FLOOR PLATES, &c., forming Flooring and Bracing.

TENDER No. 3.

For the Supply and Erection of Steel and Iron Work in HYDRAULIC MAINS, ASCENSION PIPES, GAS and TAR MAINS, &c.

Drawings may be seen and Specification, with Form of Tender and Quantities obtained (on and after Jan. 24) upon Application to the Engineer, Mr. J. W. Morrison, at the Company's Offices, Commercial Street.

The Directors do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed, must be delivered by post to Mr. Hanbury Thomas, Managing-Director, not later than the First Post on Tuesday, the 8th day of February.

WM. HAMBY,
Secretary.

Commercial Street,
Sheffield, Jan. 15, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
NORTH MIDDLESEX GAS COMPANY.

NEW ISSUE OF £7500 FIVE PER CENT. PREFERENCE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Feb 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHGATE AND DISTRICT GAS COMPANY.

NEW ISSUE OF £5000 FIVE PER CENT. PREFERENCE STOCK,
AND
£2500 SEVEN PER CENT. MAXIMUM DIVIDEND ORDINARY STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Feb. 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY.

NEW ISSUE OF £4000 FIVE PER CENT. "C" CONSOLIDATED STOCK.
AND
£4000 FOUR PER CENT. CONSOLIDATED PREFERENCE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Feb. 15, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given, that an ORDINARY MEETING of the Commercial Gas Company will be holden at the Cannon Street Hotel, in the City of London, on Thursday, the 24th of February, 1910, at Twelve o'clock at noon, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st of December, 1909; to declare a Dividend; to elect Directors and an Auditor in the place of those retiring.

The STOCK TRANSFER BOOKS WILL BE CLOSED from the 28th inst. to the 24th of February next, both days inclusive, and the Dividends will be paid on the 1st of March next to the holders of Stock registered at the date of the closing.

By order of the Board,
H. D. ELLIS,
Secretary.

Offices: Stepney,
Jan. 20, 1910.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at the Company's Offices, No. 639, High Road, Tottenham, on Saturday, the 5th day of February, 1910, at Three o'clock in the Afternoon precisely, to receive the Directors' Report and Statement of Accounts for the Half Year ended the 31st December, 1909; to declare Dividends; and to Transact the General Business of the Company.

The TRANSFER BOOKS for the CONSOLIDATED "A" and "B" STOCKS WILL BE CLOSED from Saturday, Jan. 29, to Saturday, Feb. 5, both days inclusive.

By order of the Board,
E. TOPLEY,
Secretary.

Chief Offices of the Company,
639, High Road, Tottenham.
Jan. 20, 1910.

Just Published. Demy 8vo. 168 pages. 109 Illustrations.
8s. 6d. net.

MODERN COKING PRACTICE,

Including the Analysis of Materials and Products.

A Handbook for those engaged in Coke Manufacture and the Recovery of Bye-Products.

By T. H. BYROM, F.I.C., F.C.S., Mem. Soc. Chem. Indus., Chief Chemist to the Wigan Coal and Iron Company, And J. E. CHRISTOPHER, Memb. Soc. Chem. Indus., Lecturer on Coke Manufacture at the Wigan Technical College.

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Is now used in many Gas-Works throughout Scotland with gratifying success.

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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

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15 Patents. Highest Awards.
Work easily and quickly. Reliable.

For Earth-Working, Boring, Soil-Testing, Planting, Sinking Fences, Posts, and various other uses.

Borers from 60 to 400 mm. (2⅜ in. to 16 in.) diameter.

Great Saving of Labour. Low Prices.

Catalogue Gratis.

E. JASMIN,
Hamburg 30, Lehmweg 30.

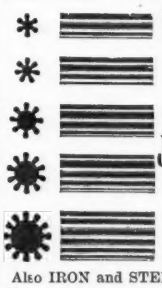
MIRFIELD GAS COAL.

UNEQUALLED.

Sperm Value 878·85 lbs. per Ton.

Please apply for Price, Analyses, and Report, to the

MIRFIELD COLLIERY COMPANY,
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 16, Park Village East, N.W.



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Also IRON and STEEL WIRE of all descriptions.

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Manufacture and keep in Stock at their Works (also large Stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

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"Presto," 7½", as illustrated, retails complete, 1/9;
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Refills (5000 sparks) 9d. and 1/- each retail.
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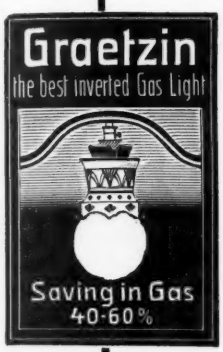

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1. **20-Candle Power more light** without increase in the consumption of gas.
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From Lamps with more than one burner, the injectors can be removed from the outside, without taking the lamps to pieces.

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Every Genuine Glenboig Brick, Block, Gas-Retort, &c., is legibly stamped with one or other of the Glenboig Company's Registered Trade Marks, as here shown.

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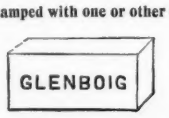

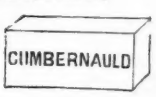

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Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analyses where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

23, LEADENHALL STREET,
LONDON, E.C., September 21st, 1909.

DEAR SIRS,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 100° C.	3·70 %
" " " 1050° C.	4·76 %
" " Total	8·46 %
Volume shrinkage at 100° C.	10·7 %
" " " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	30·0 %
Fire Stability	1850° C. equiv. to 3362° F.

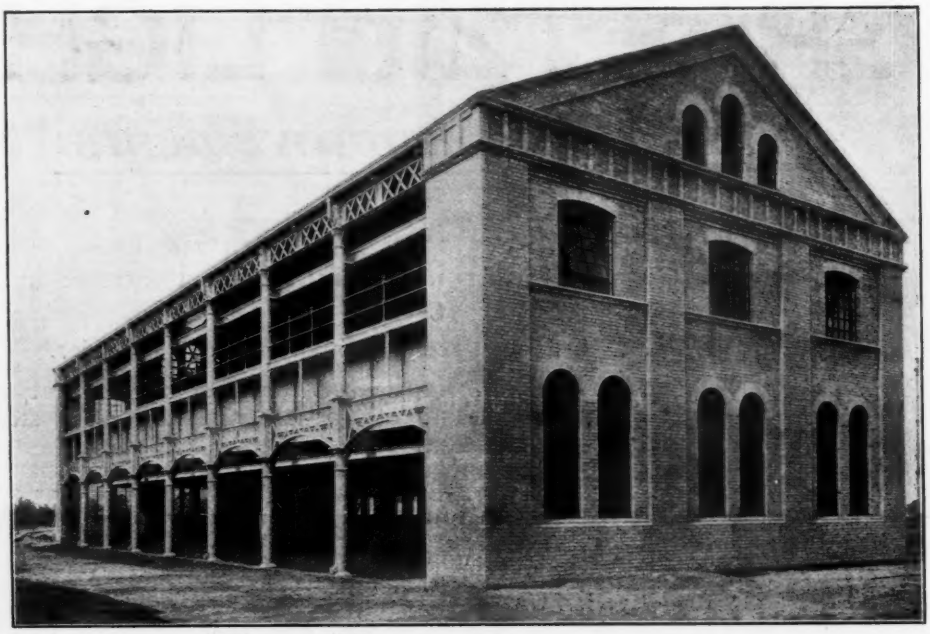
(SEGER CONE 36.) (New Scale CONE 38.)

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.

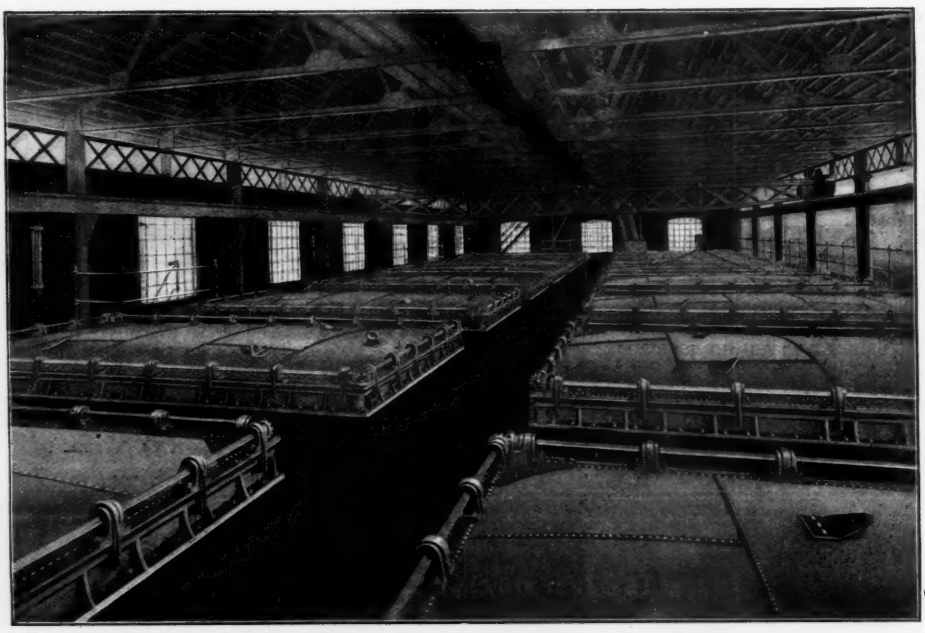
OVER 500 MILBOURNE PATENT VALVES IN USE.



Milbourne Patent

PURIFIERS

and VALVES.



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FOR ALL THE
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COAL CONVEYING PLANTS
COMPLETE WITH
ELEVATORS, CONVEYORS, BREAKERS, &c.

THOMAS PIGGOTT & CO., LTD.,
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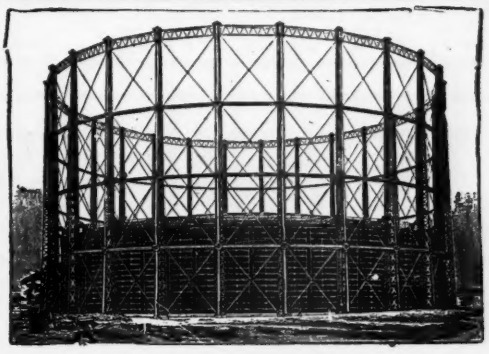

Triple Lift Gasholder, 212 ft. 6 in. diameter by 45 feet Lifts, erected at Garston, Liverpool.

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GAS PLANTS.
STEEL PIPES.
STEEL TANKS.
CONSTRUCTIONAL STEEL WORK.

HUMPHREYS & GLASGOW'S CARBURETTED WATER-GAS PLANTS.
Aggregate capacity of Plant supplied
228,600,000 cubic feet daily.

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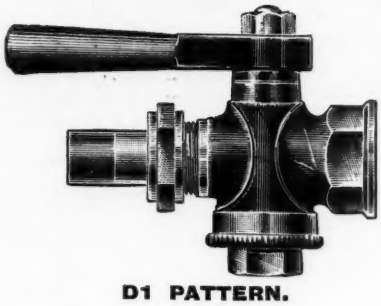
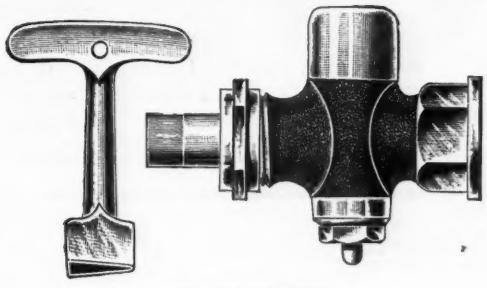


D1 PATTERN.



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Brass Gas-Fittings, Wrought-Iron Gas and Steam Tubes, Coke Forks and Shovels always in Stock. Coke Barrows, Tools of all Descriptions.

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THE VERTICAL GAS RETORT SYNDICATE, LIMITED,

(DESSAU SYSTEM)

17, VICTORIA STREET, WESTMINSTER, S.W. (See Full Page Advertisement, p. I., Nov. 30.)

THE WIGAN COAL & IRON CO., LIMTD.,

Are the exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, Wigan, and of the Manton Steam and House Coal Collieries, Worksop, Notts, and supply the well-known Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, House and Steam Coals, &c.

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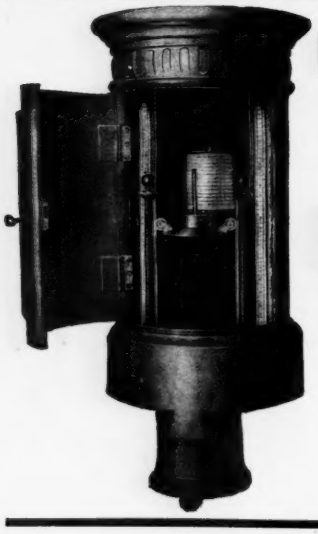

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DISTRICT GOVERNOR

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PILLAR BOX contains Air-Pressure Holder for Loading the Governor from a distance also Recording Gauge and Inlet and Outlet Pressure Gauges.

LARGE MERCURIAL GOVERNOR.
From a Photo. of 24 in. Size.
May be Loaded by Weights or Air Pressure from a Distance.

Memo.

MOBBERLEY & PERRY OF STOURBRIDGE

LIMITED,

are receiving large repeat orders for Home and Abroad for their special quality of Gas Retorts, Fire-Bricks, &c.

Welsbach LIGHT

Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

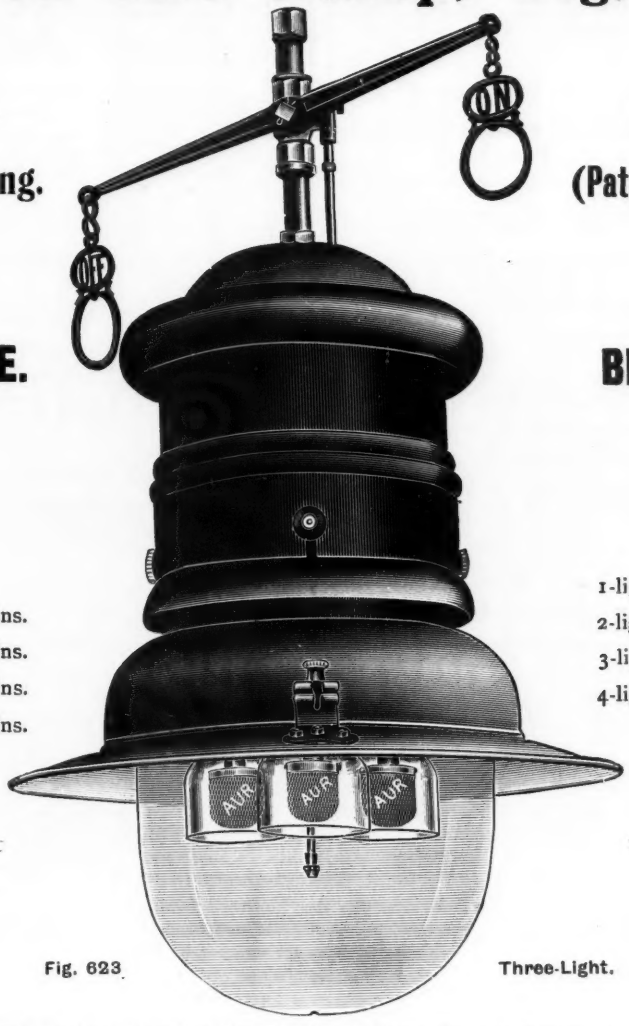

Fig. 623. Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

		1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra	each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra	"	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
Welsbach House, 344-354, Gray's Inn Road, London, W.C.
Telegrams and Cables: "WELSBACH LONDON." *Telephone 2410 NORTH.*

MAIN LAYING.

Paper by PERCY GRIFFITH, M.Inst.C.E., and BRUCE McGREGOR GRAY, Assoc.M Inst.C.E., before the Association of Water Engineers.

A. The Authors used *Flanged Pipes* for the Rising Main up the Steep side of the Barff, and their experience proved that this was not an advantage, as *the rigidity of the Joints involved considerable difficulty* in regard to the depth of the Trench, and a good deal of Cutting to make the final Connections at each end of the Pipe-Line.

B. In the case of the Delivery Main, the Joints were *Ordinary Socket Joints*, but made with Lead only. The only difficulty met with here was the necessity for *pouring the Lead in* at a suitable temperature *to prevent it melting the Solid Lead Fillet*, and *running through into the Pipe.*

C. In some of the Smaller Branch Connections, Lead Wool was used, and proved highly successful.

Particulars from

THE LEAD WOOL CO., LTD., SNODLAND, KENT.

EVERITT'S Patent

TAR-FOG EXTRACTOR

AND

NAPHTHALENE REMOVER.

SOLE MAKERS:

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— 2000 Workmen. —

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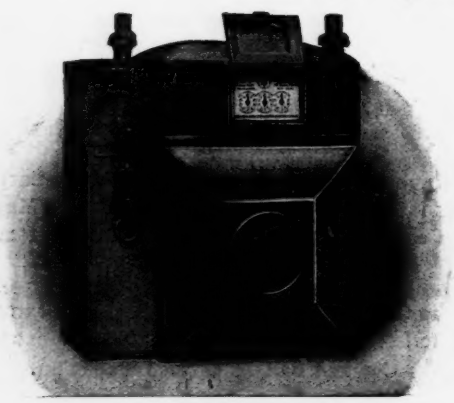

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They are FAR cheaper and more economical in the long run, and a source of great satisfaction to all users.

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GREASE REMOVER
For CLEANING GAS STOVES

still leads for being the

Finest
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Cheapest

method for dealing with this perplexing problem.

Although only introduced 2 years ago, we number amongst our

REGULAR CUSTOMERS

The LARGEST to the SMALLEST GAS COMPANIES in UNITED KINGDOM.

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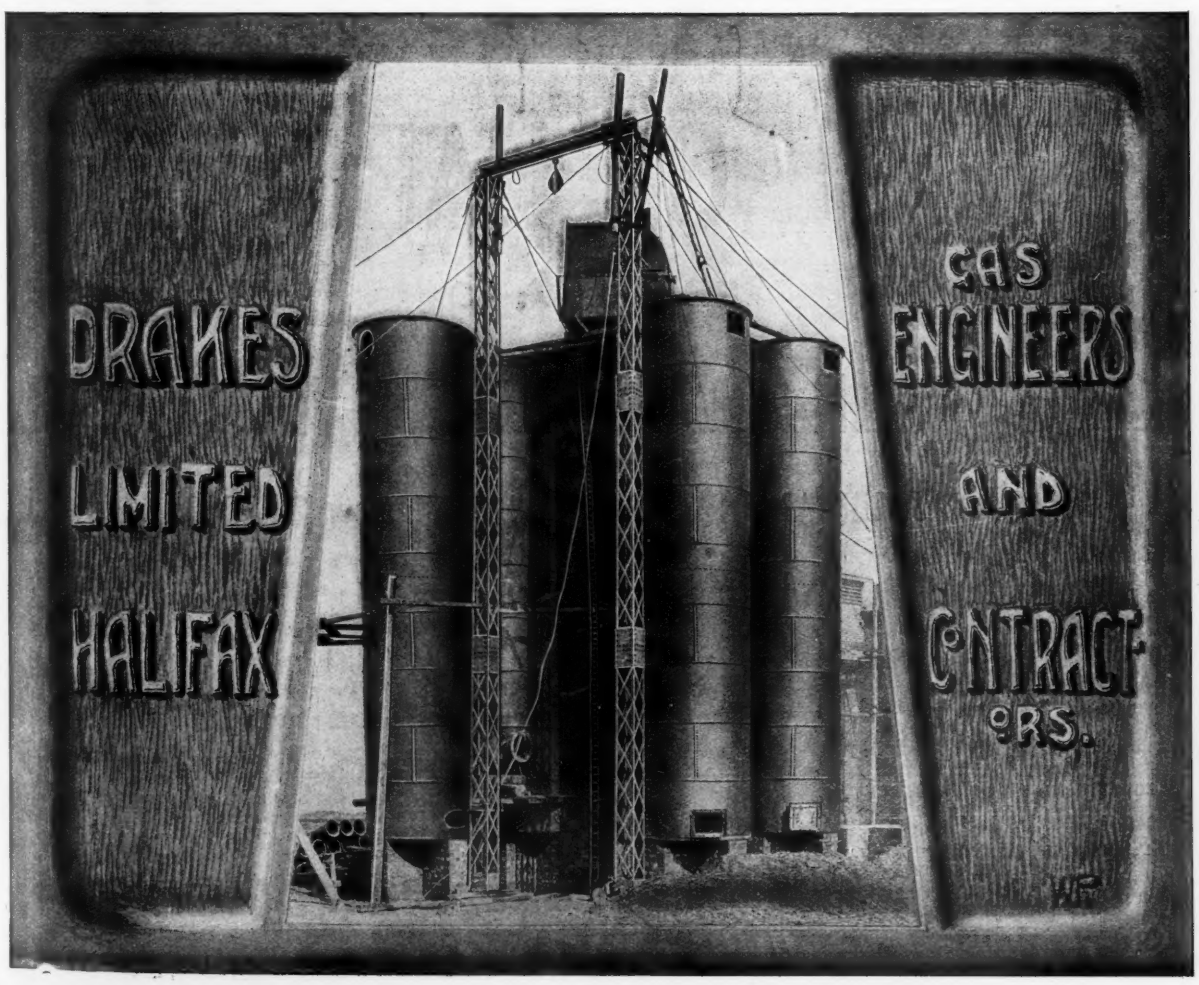

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IN

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See "JOURNAL OF GAS LIGHTING," Nov. 2, 1909.

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